FM 6-75

FM 6-75

DEPARTMENT OF THE ARMY FIELD MANUAL

Reference C1, 2 RESCINDED Per DA

105-MM HOWITZER M101-SERIES TOWED

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HEADQUARTERS, DEPARTMENT OF THE ARMY

FEBRUARY 1963

REFERENCE

RESCINDED for DA Pam 25-30 Change #1, June 1990

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *27 January 1969*

105-MM HOWITZER, M101-SERIES, TOWED

FM 6-75, 26 February 1963, is changed as follows:

Page 40. Paragraph 38*d* is superseded as follows:

d. Range Quadrant Adjustment.

(1) Center the cross-level bubble.

(2) Check the angle of site scale. It should read 3(300). If the angle of site scale does not read 3(300), loosen the two screws on the scale and move the digit 3 into coincidence with the index. Tighten the screws and recheck.

(3) Check the angle of site micrometer scale. It should read zero and the knob should be locked. If the angle of site knob is not locked with the scale reading zero, see C 8, TM 9-325.

(4) With the elevation knob, center the longitudinal-level bubble.

(5) Check the elevation scale. It should read zero. If the elevation scale does not read zero, loosen the two screws on the moveable index and slip the index so that it is in coincidence with the zero. Tighten the two screws and recheck the setting.

(6) Check the elevation micrometer scale. It should read zero. If it does not read zero, loosen the three locking screws on the knob, slip the scale so that the zero is in coincidence with the elevation micrometer index. Tighten the screws and recheck the setting.

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(7) Recheck both bubbles, all scales and indexes.

(8) The adjustment is complete when both bubbles are centered and all scales are at zero except the angle of site scale which should read 3(300).

Page 43. Paragraph 40*g* is superseded as follows:

g. Adjust the range quadrant as follows:

(1) Cross-level the quadrant.

(2) Check the angle of site scale and micrometer scale to ascertain that reading is locked at 300.

(3) Adjust elevation scale and elevation micrometer scale to read zero. See paragraph 38*d*.

Page 54. Paragraph 50*d* is superseded as follows:

d. Place the quadrant on the leveling plates being careful not to reverse the line-of-fire arrow; the bubbles should center.

Note. Do not disturb the lay of the tube.

Page 56. Paragraph 52*e* is superseded as follows:

e. Range quadrant test. Level the tube with the gunner's quadrant, cross-level the range quadrant. Check the angle of site scale and angle of site micrometer to ascertain that reading is locked at 300. Center the longitudinal-level bubble by turning the elevation knob. The elevation scale and elevation micrometer scale should read zero; if they do not, adjust the scales.

Located in back of manual, table I.

Sequence 9, Assistant gunner column. In lines 2 and 3, "sets sight at 300 and centers bubbles;" is changed to read "verifies that angle of site is locked at 300; centers bubble;."

Located in back of manual, table II.

Sequence 2, Assistant gunner column, step 1. In line 2, "is set at 300" is changed to read "is locked at 300."

Sequence 2, No. 2 column. "Caution" (lines 37 and 38) is rescinded.

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12–11 requirements for 105 MM Howitzer, M 101-Series, Towed.

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REFERENCE

CHANGE
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DEPARTMENT OF THE ARMY
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105-MM HOWITZER, M101-SERIES, TOWED

FM 6–75, 26 February 1963, is changed as follows:

Page 18, paragraph 20. Line 5 "(aiming posts)" is changed to read "(aiming post or collimator)."

Page 18, paragraph 20. The following note is added immediately below the last line of text:

Note. See figure 7.1.

Page 18. Figure 7.1 is added as follows:

Page 28, paragraph 29. Line 3 "the aiming posts" is changed to read "the infinity aiming reference collimator (or aiming posts)."

Page 30. Paragraph 29*d* is added as follows:

d. The infinity-aiming reference collimator is an optical instrument which simulates an azimuth reference target at infinity. The collimator is alined with the vertical reticle of the panoramic telescope as directed by the gunner.

(1) The collimator is emplaced from 4 to 17 meters from the left side of the howitzer.

(2) While the howitzer is being laid, number 4 alines the optical system of the collimator on the center of the telescope ro-

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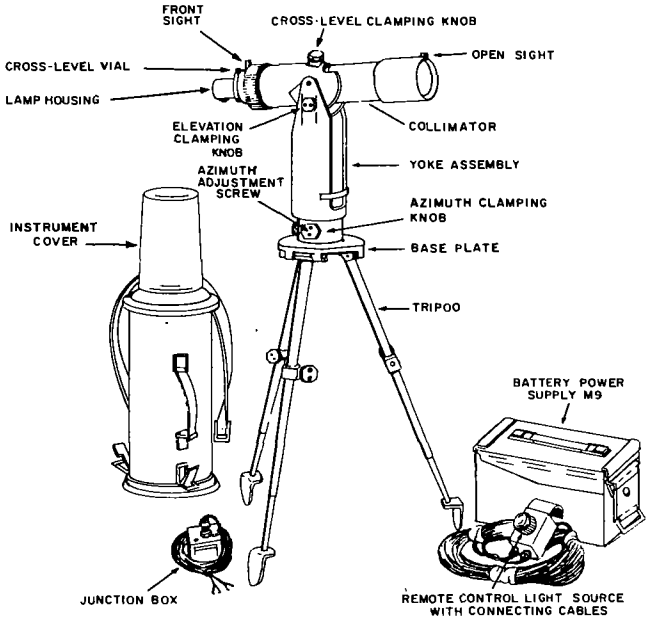

Figure 7.1. Infinity-aiming reference collimator and auxiliary equipment.

tating head and cross-levels the reticle pattern.

(3) After the howitzer is laid, the gunner directs number 4 in alining the 0 line of the collimator reticle with the vertical reticle of the panoramic telescope.

(4) To lay for direction during firing, the gunner sets the announced deflection on the panoramic telescope and alines the appropriate number on the panoramic

telescope reticle with the same number in the appropriate direction on the collimator reticle. This procedure for laying also compensates for weapon displacement (fig. 8.1).

Note. For positive identification, an area at least 7 mils in diameter must be seen at all times on the collimator reticle.

Page 30. Figure 8.1 is added as follows:

Page 87, paragraph 83*b*(6). Line 1 "Aiming posts" is changed to read "The infinity-aiming reference collimator (or aiming posts)."

Pages 87 and 88, paragraph 83*c,* Test No. 2 and 11. Third item in Action of Candidate column is changed to read "Lays on collimator (aiming posts)."

Page 92, paragraph 86*b*(1). Line 1 "Aiming posts" is changed to read "The infinity-aiming reference collimator (or aiming posts)."

Page 92, paragraph 86*b*(2) is rescinded.

Page 93, paragraph 86*b*(4). Line 1, the words "The far post or" are deleted.

Page 93, paragraph 86*c*(1). Item 1 in Action of Candidate column is changed to read "Lays the piece to correct for collimator or aiming post displacement."

Page 93, paragraph 86*c*(2). Item 2 in Action of Candidate column is changed to read "Directs assistant in alining the collimator (or aiming posts)."

Page 93, paragraph 86*d*(1)(*a*). Line 1 is changed to read "If the reticle of the Panoramic

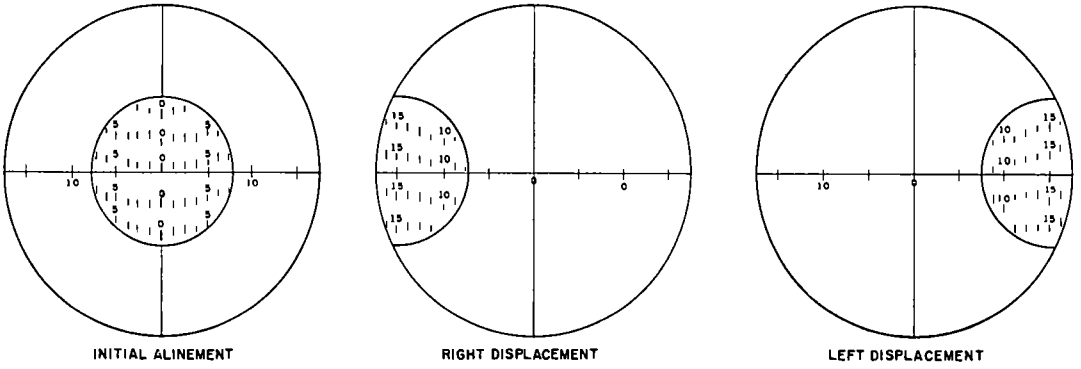

Figure 8.1. Gunners sight picture of collimator when correcting for displacement.

telescope does not match with the reticle pattern of the collimator, or if using aiming posts, the far aiming post does not appear."

Page 94, paragraph 86*d*(2). Subparagraphs (*b*) and (*c*) are superseded as follows:

(*b*) The collimator (or aiming posts) are not properly alined.

(*c*) The vertical reticle of the telescope does not match the reticle pattern of the collimator. If aiming posts are used, the vertical reticle of the telescope is not on the aiming posts.

Located in back of manual, table I.

Sequence 8, No. 4 column. Last item is changed to read "Removes the aiming posts or collimator from the traveling position, assembles them (it) and places them (it) to the right of the piece."

Sequence 12, Gunner column.

Line 1 is changed to read "*Directs alinement of aiming posts or the infinity-aiming reference collimator."

Line 3 is changed to read "scope, or illuminates the reference collimator reticle, and refers the vertical hairline of the panoramic telescope to the center of the reticle."

Line 6 is changed to read "telescope, or directing number 4, alines the zero line of the collimator with the vertical reticle of the panoramic telescope. (Minor adjustment may be made by both the gunner and number 4, to insure exact coincidence.)"

Sequence 12, No. 4 column. The following item is added:

"If the infinity-aiming reference collimator is used, assists the gunner in orienting it."

Located in back of manual, table III.

Sequence 3, Chief of Section column. Line 1, "TARGET (TANG, etc.)" is changed to read "TARGET (TANK, etc.)."

Bottom of table, ONE-MAN, ONE-SIGHT SYSTEM portion, 2d column, *Note* below item 5 is superseded as follows:

Note. The reticle on the panoramic telescope M12A7D, is graduated for shell HE, Charge 5. When firing charge 7, with this telescope, at ranges under 2,400 meters; use one-half of the true range for laying on the target. For shell HEP–T, use one-third of the true ranges under 2,000 meters. No range correction is necessary for shell HE, charge 7 on the M12A7H panoramic telescope.

Located in back of manual, table IV.

Sequence 5, No. 4 column is changed to read "Recovers, and stows the reference collimator (aiming posts if required)."

Table V is superseded (located in back of this change).

Table V. Trajectory Characteristics, Shell HE, Charge 7; Shell HEP–T

Shell HE, Chg. 7.

Range (meters)	Elevation	Trajectory characteristics	Firing data	Range (meters)	Elevation (mils)
100	2	Within these ranges, the trajectory is flat enough to prevent an 8-foot tank from passing under it. A range of 400 meters is ideal for opening fire on the target.	Start firing using a 400 meter range setting.	100	2
200	5			200	3
300	7			300	5
400	10			400	7
500	12			500	9
				600	11
				700	13
600	15	Within these ranges, bracket adjustment of the target is required. 200 meter range changes should be made until a bracket is obtained.	1. Start firing with the estimated range at the closest 100 meter range. 2. Adjustment on the target by bracketing (overs and shorts) is required. 3. Make 200 meter range changes until a bracket is obtained.	800	15
700	17			900	18
800	20			1,000	20
900	23			1,100	22
1,000	25			1,200	25
1,100	28			1,300	28
1,200	31			1,400	31
1,300	34				
1,400	37				
1,500	40	At ranges over 1,400 meters, bracket adjustment of the target is also required. 400 meter range changes should be made until a bracket is obtained.	1. Start firing with the estimated range at the closest 100 meter range. 2. Adjustment on the target by bracketing (overs and shorts) is required. 3. Make 400 meter range changes until a bracket is obtained.	1,500	34
1,600	43			1,600	37
1,700	46			1,700	40
1,800	49			1,800	44

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12–11 requirements for 105 MM Howitzer, M101 Series, Towed.

☆ U.S. Government Printing Office: 1967—305-585/6164C

FIELD MANUAL
No. 6–75

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *26 February 1963*

105-MM HOWITZER M101-SERIES TOWED

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* This manual supersedes FM 6–75, 1 December 1960, including C 1, 15 May 1962.

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CHAPTER 1
GENERAL

1. Purpose and Scope

a. This manual is a guide to assist commanders and chiefs of sections in developing 105-mm howitzer M101A1, towed sections into teams that will operate effectively in battle.

b. This manual prescribes the duties of the section personnel in—

(1) Section drill.
(2) Preparation for firing and traveling.
(3) Firing.
(4) Tests and adjustments.
(5) Maintenance and inspections.
(6) Decontamination of equipment.
(7) Destruction of equipment.

c. This manual is applicable to both nuclear and nonnuclear warfare without modification.

d. To improve this manual, users are encouraged to submit recommended changes and comments. The procedure is as follows:

(1) Key comments to the specific page, paragraph, and line.
(2) Include supporting reasons with each comment.
(3) Send direct to U. S. Army Artillery and Missile School, ATTN: AKPSIPL, Fort Sill, Okla.

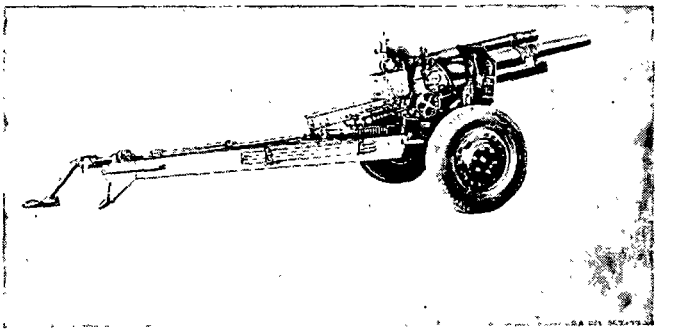

Figure 1. 105-mm howitzer M101A2, towed.

2. Composition of the Howitzer Section

The personnel of the howitzer section are the—

a. Chief of Section (CS).

b. Gunner (G).

c. Assistant Gunner (AG).

d. Five cannoneers, numbered 1 through 5.

e. Prime Mover Driver (D).

3. Duties of the Chief of Section

The chief of section is the noncommissioned officer in command of the section. He is responsible for the—

a. Training and efficiency of personnel.

b. Performance of duties in drill, firing, tests and adjustments, inspection, and maintenance.

c. Observance of safety precautions.

d. Preparation of field fortifications.

e. Camouflage discipline; local security; and chemical, biological, and radiological security discipline.

f. Maintenance of Equipment Log Book (TM 38–750).

g. Police and improvement of the section area.

4. Equipment

Section equipment is shown in figure 2.

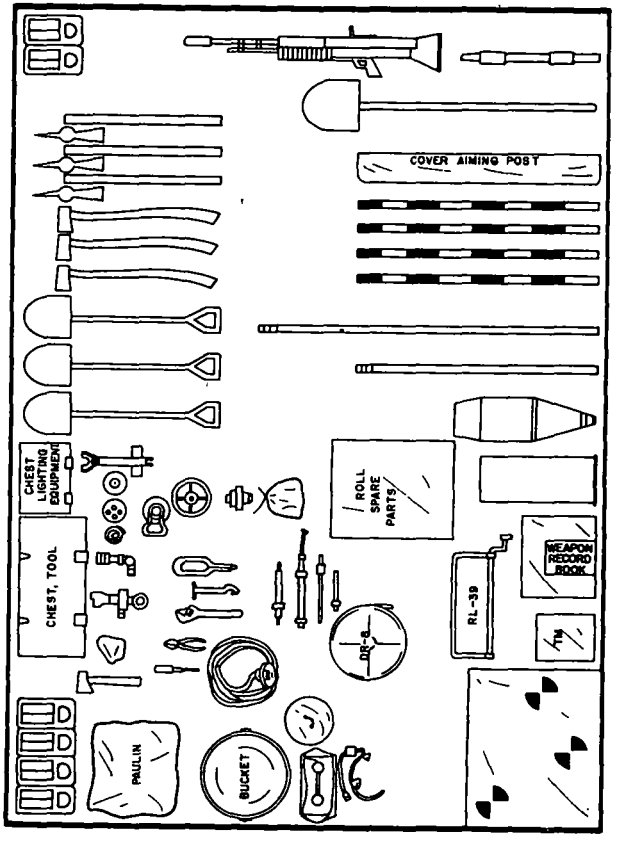

Figure 2. Section equipment, 105-mm howitzer.

5. Definitions

a. Front.

(1) The front, howitzer coupled, is the direction in which the prime mover is pointed.

(2) The front, howitzer uncoupled, is the direction in which the muzzle points.

b. Right (left). The right (left) of one facing to the front.

6. References

Publications applicable to the 105-mm howitzer M101 series, towed, are listed in the appendix.

CHAPTER 2
SECTION DRILL

Section I. GENERAL

7. Purpose

This chapter prescribes the—

a. Objectives and instructions for section drill.

b. Commands and formations for section drill.

8. Objectives

The objective of section drill is the attainment of efficiency: precision coupled with high speed.

9. Instructions

Section drill will be—

a. Conducted in silence except for commands and reports.

b. Repeated until reactions are automatic, rapid, and efficient.

c. Supervised so that mistakes are discovered, reported, and corrected immediately.

d. Supervised by battery officers to insure uniformity and efficiency.

e. Conducted so that each member of the section can perform all duties within the section.

Section II. COMMANDS AND FORMATIONS

10. Forming the Section

To form the section, the chief of section takes his post and gives one of the following commands:

a. To form the section the command is FALL IN. The section—

(1) Moves at double time.

(2) Forms in single rank at close interval, with the gunner on the right, the assistant gunner, the cannoneers in numerical order, and the driver at the left of the rank.

(3) Centers on the chief of section at a distance of 3 paces (fig. 3).

b. To form the section in a particular place, the commands may be 1. IN FRONT (REAR) OF YOUR PIECE, 2. FALL IN. The section—

(1) Moves and forms a single rank as in *a* above.

(2) Faces the direction of fire.

c. To form the section in a particular direction the commands may be 1. ON THE ROAD FACING THE PARK, 2. FALL IN. The Section—

(1) Moves and forms a single rank as in *a* above.

(2) Faces the direction indicated in the command.

d. At the first formation for a drill or exercise, the caution "as a section" precedes the command.

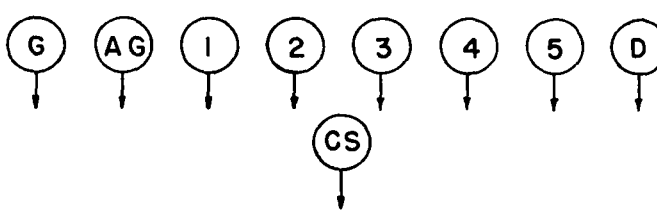

Figure 3. Section in formation.

11. To Call Off

With the section in formation, the command is CALL OFF.

a. All personnel except the gunner execute eyes right.

b. The section calls off in sequence: "Gunner, Assistant Gunner, 1, 2, 3, 4, 5, Driver."

c. As each man calls out, he turns his head smartly to the front.

12. To Take Posts

The command is 1. CANNONEERS, 2. POSTS.

a. The command is general and may be given in or out of ranks, at a halt, or marching.

b. All movements are executed at double time and are terminated at the position of attention.

c. The section moves to posts as shown in figures 4, 5 and 6.

13. To Change Posts

To train all members of the section in all duties, posts should be changed frequently. With the section in *formation,* the commands are—

a. 1. CHANGE POSTS, 2. MARCH.

(1) Number 5 moves at double time to the post of the assistant gunner.

(2) The assistant gunner and numbers 1 through 4 take two left steps, each cannoneer taking the position of the next higher numbered cannoneer.

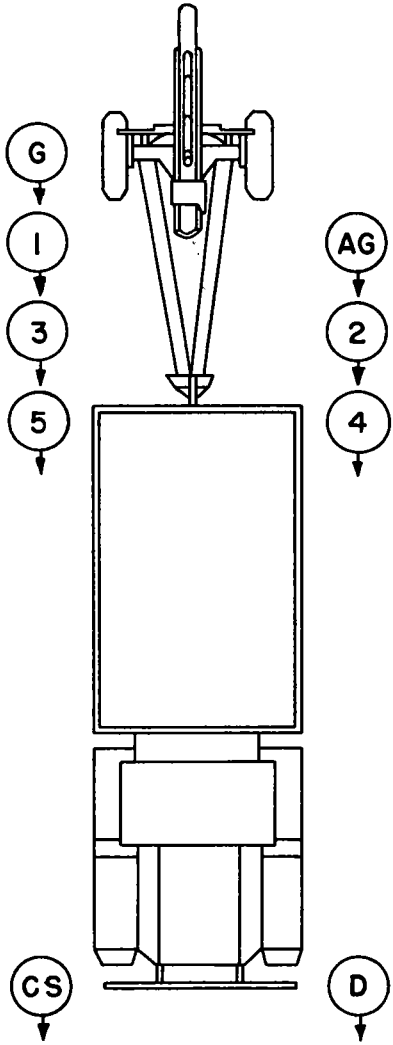

Figure 4. Posts, uncoupled.

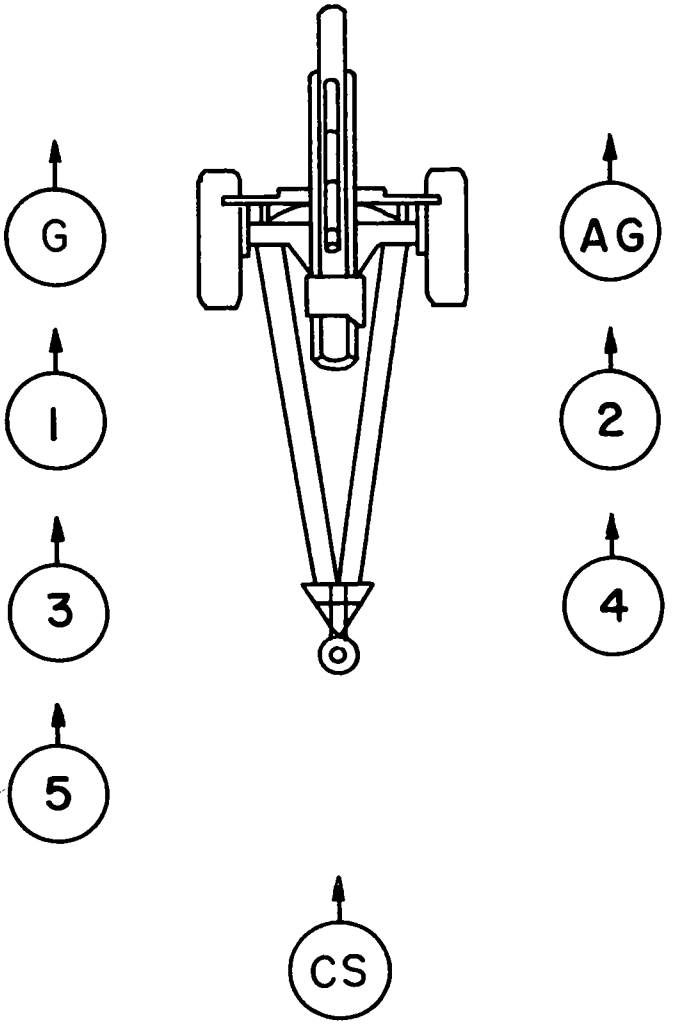

Figure 5. Posts, uncoupled, march ordered.

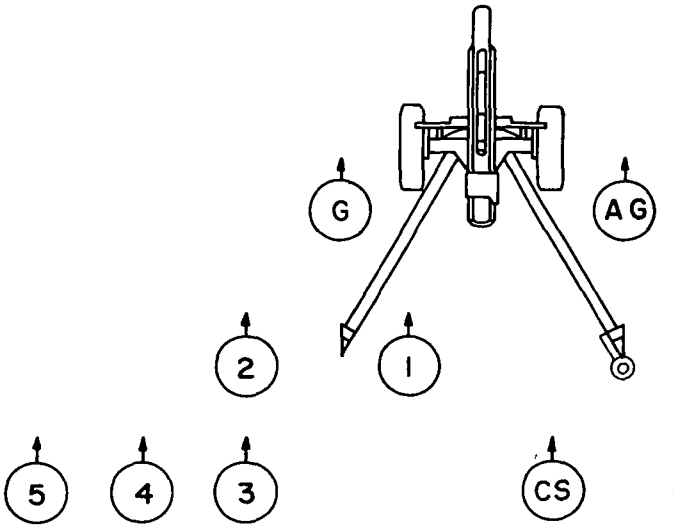

Figure 6. Posts, prepared for action.

b. 1. SECTION CHANGE POSTS, 2. MARCH.

(1) The leftmost man moves at double time to the post of gunner.

(2) All other men move as in *a* above.

14. To Mount

To mount, the following commands may be given:

a. 1. PREPARE TO MOUNT, 2. MOUNT.

(1) At the preparatory command, the section moves at double time to positions shown in figure 4.

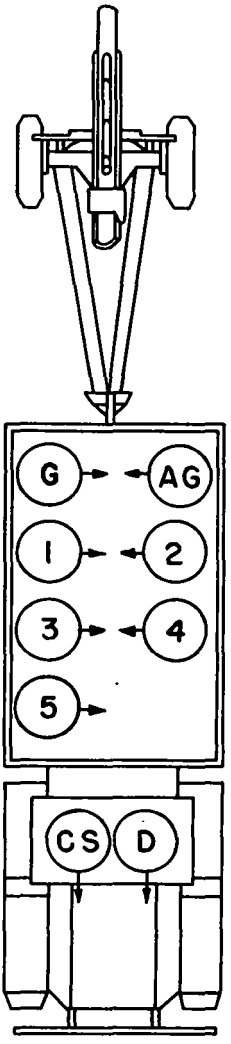

Figure 7. Posts, coupled mounted.

(2) At the command of execution, personnel mount and take positions as shown in figure 7.

(3) Each cannoneer is assisted by the man directly behind (or in front) to insure rapid mounting, and to prevent injuries.

(4) Before the chief of section mounts he will verify that the load is properly coupled, that personnel and equipment are aboard and that the tail gate and safety strap are secure.

(5) If any member of the section is not to mount, he is designated and cautioned to stand fast. 1. PREPARE TO MOUNT, DRIVER STAND FAST, 2. MOUNT.

b. MOUNT. The section moves directly to the positions shown in figure 7.

15. To Dismount

To dismount the following commands may be given:

a. 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

(1) At the preparatory command, personnel assume a standing position in order to dismount rapidly.

(2) At the command of execution, personnel jump to the ground and take positions as shown in figure 4.

b. DISMOUNT. The section moves without delay to positions as shown in figure 4.

16. To Fall Out

The command FALL OUT is given to provide rest and relief during drill or firing.

a. During Drill.

(1) The command may be given at any time.

(2) The section remains in vicinity of drill area.

b. When Firing.

(1) The command may be given when firing is temporarily suspended.

(2) The section remains in vicinity of, but clear of the piece.

(3) The settings and layings are not disturbed.

CHAPTER 3

DUTIES OF THE HOWITZER SECTION

Section I. PREPARATIONS FOR FIRING

17. Purpose

This chapter prescribes duties for—

a. Preparing the howitzer for firing (table I).

b. Firing by indirect laying (table II).

c. Firing by direct laying (table III).

d. Preparing the howitzer for traveling (table IV).

Table I. Duties in Prepare for Action
(Located in back of manual)

Table II. Duties in Firing, Indirect Laying
(Located in back of manual)

Table III. Duties in Direct Laying
(Located in back of manual)

Table IV. Duties in Preparation for Traveling
(Located in back of manual)

18. At the Position

a. The howitzer is emplaced under direct supervision of the chief of section.

b. Preparation of the firing position prior to occupation is governed by time factors and unit SOP. The following preparation will, however, facilitate the occupation:

(1) Mark the position with a stake to indicate the place over which the panoramic telescope is to be located.

(2) Place another stake at a distance of 50 to 100 meters, in the approximate direction of fire, at which the tube can be pointed.

c. Spade pits should be dug if time permits. The spades may be seated by firing in soft ground, but carriage displacement will be greater than if the spades had been dug in initially.

d. A recoil pit must be dug for high-angle fire. After the piece is emplaced, elevate it to maximum elevation. Dig the recoil pit to provide a 50-inch clearance between the breech and the ground, and clearance throughout traverse limits. The pit should be covered when not firing high-angle in order to facilitate service of the piece.

19. To Prepare for Action

a. The command is PREPARE FOR ACTION.

(1) The command may be given with the howitzer in position or approaching the position.

(2) Duties of individuals are given in table I.

(3) Each man takes his post (fig. 6) when he has completed his duties.

b. All duties are conducted at double time.

c. If the howitzer is not to be prepared for action at the firing position, a supplementary command DO NOT PREPARE FOR ACTION must be given.

Section II. FIRING

20. Firing by Indirect Laying

The vast majority of targets will be attacked by indirect laying. Indirect laying is a method of taking targets under fire by placing the line of sight of the panoramic telescope on an aiming point other than the target (aiming posts). To provide timely and accurate fire, the section must be indoctrinated with a sense of urgency. Every effort must be made to execute the timely and effective delivery of fire. A detailed list of duties is contained in table II.

21. Firing by Direct Laying

Some targets may be attacked by direct laying. This is a method of taking the target under fire by sighting directly on the target. Since such targets are usually capable of returning fire, the following factors must be emphasized:

a. Speed and accuracy in laying.

b. High standards of training.

c. Section operation as an independent unit.

22. Methods of Direct Laying

a. Sighting System. The two-man, two-sight system is the principal sighting system to be used with the weapon.

(1) The gunner establishes lead with the panoramic telescope.

(2) The assistant gunner establishes range with the elbow telescope.

b. One-Man, One-Sight System. The one-man, one-sight system in which the gunner lays for both deflection and elevation may be used if required. However, the two-man, two-sight system provides faster laying, better accuracy, and a greater assurance of first round hits.

c. Laying Method. Central laying is used.

(1) The gunner places the appropriate vertical reticle of the telescope on the center of the target.

(2) The assistant gunner places the appropriate range line of the elbow telescope on the center of the target.

d. Tracking the Target. After lead and range are laid on the target, continuous tracking is maintained during the firing sequence.

e. Specific Duties in Firing. Specific duties in firing by direct laying are shown in table III.

23. Range Card

a. The chief of section is responsible for the defense of his assigned sector. He should also be prepared to deliver fire in all sectors (directions).

b. During reconnaissance of the position and shortly after occupation of position, the chief of section will—

(1) Measure or estimate the ranges to prominent terrain features and likely avenues of approach.

(2) Establish reference points as required.

(3) Prepare a range card (fig. 8).

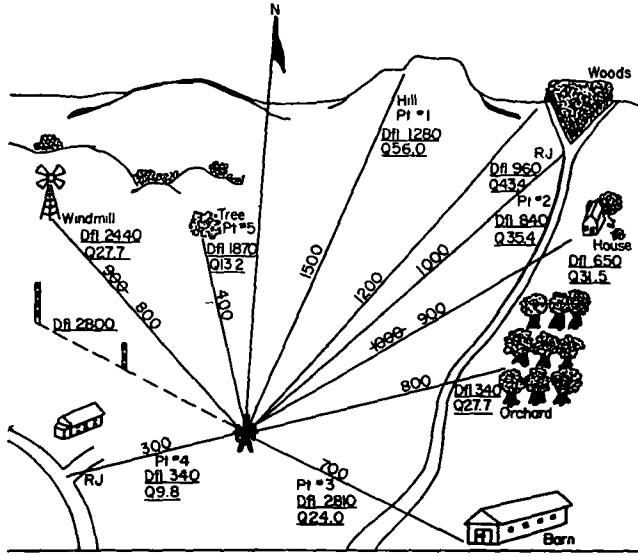

Figure 8. Range card for direct laying.

(4) As time permits, replace estimated ranges with more accurate ranges obtained by pacing, taping, speedometer, maps, or survey.

c. The executive officer will assign numbers to certain prominent terrain features to facilitate target location. For example, the executive commands, TARGET, TANKS POINT NUMBER 2, FIRE AT WILL.

d. As time permits, a deflection and a quadrant for each numbered point should be added to the range card to expedite and increase accuracy in firing.

Table V. Trajectory Characteristics, Shell HE, Charge 7; Shell HEP–T
(Located in back of manual)

e. The field of fire of the section should, if possible, be cleared of obstructions that might hinder fields of fire or observation. Care must be taken not to expose the location of the position.

24. Trajectory Characteristics

Trajectory characteristics for different ranges must be considered prior to taking a target under fire. Information contained in table V provides data, covering the effective direct fire ranges of the weapon.

25. Preparations for Traveling

The command is MARCH ORDER.

a. Duties of individuals are given in table IV.

b. Each man takes his post (fig. 4), when he has completed his duties.

Section III. PREPARATION FOR AIRMOBILE OPERATIONS (TYPE A AND B LOADS)

26. General

a. Disassembly, and assembly of the howitzer for airmobile operations requires 10 persons for the type A load, and 15 persons for the type B load. It is required, therefore, that the section be augmented to perform the operation.

b. The special equipment required is lifting bars, nylon webbing, and miscellaneous tools.

c. If the medium cargo helicopter is used, the howitzer can be lifted in one load. The nylon straps are connected to each wheel and the lunette ring and drawbar as in the type A and B loads.

27. Procedures

a. Disassembly—Type A Load.

(1) The assistant gunner and the No. 2 cannoneer remove auxiliary shield from the right side of the howitzer while No. 1 and 3 remove the shield from the left side (special tools required for removal of shields are available in the battery maintenance section) (fig. 9).

(2) No. 1 man removes the sights and breechblock assembly from the breech recess and places them in section chest.

(3) No. 3 places a 12-inch block of wood between the equilibrator rear seat and fulcrum to neutralize the stress of the equilibrator. Places the lifting bars on the carriage between the elevating arcs and the recoil mechanism (length of bars running front and rear), and straps them on with two adjustable nylon straps which are 3 feet long.

(4) No. 5 removes howitzer locking ring and places it in section chest.

(5) The lifting bar is inserted horizontally through the breech recess in the breech ring by No. 1. No. 1, 3, and 5 will carry the portion of the bar extending out the left side and the assistant gunner, No. 2,

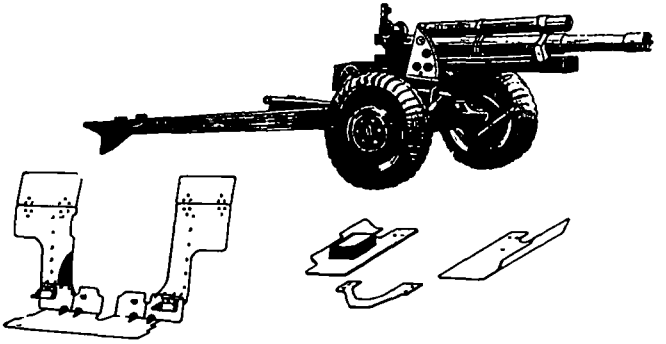

Figure 9. Shields removed (type A or B load).

and 4 will man the right side. The tube is drawn to the rear of the howitzer and the second lifting bar is placed under the forward portion of the tube before it clears the carriage. The two extra cannoneers will man and support the left portion of the bar at the muzzle end while the chief of section and gunner support the right portion.

(6) The howitzer tube is carried to the assigned helicopter loading point.

(7) The howitzer carriage is towed or manhandled to its assigned helicopter loading point and trails are closed.

(8) The chief of section supervises No. 2, 3, and 4 cannoneers in rigging the howitzer carriage for helicopter lift (fig. 10).

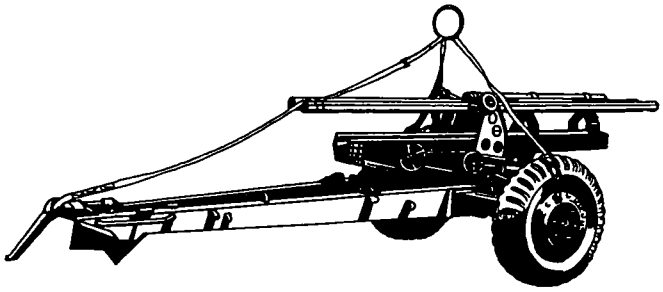

Figure 10. Carriage and recoil mechanism prepared for type A load.

(*a*) No. 4 cannoneer holds nylon ring with three straps attached.

(*b*) No. 1 cannoneer places chain on left wheel at top center while No. 2 places chain in same position on right wheel.

(*c*) No. 4 takes position on the cradle while No. 1, 2, and 3 takes the long strap and slips the loop over the lunette ring and drawbar.

(*d*) No. 1 takes the nylon strap on the left side and connects the loop in the end to the clevis attached to the wheel. No. 2 man completes the same operation on the right side.

(*e*) No. 4 places sight mounts in a position which will not interfere with nylon straps.

(*f*) No. 1 and 2 tape straps with masking tape to prevent them from slipping under sight mounts when slack is taken up during helicopter lift.

(9) The gunner supervises the assistant gunner, No. 5, and one extra cannoneer in rigging the howitzer tube for helicopter lift (fig. 11).

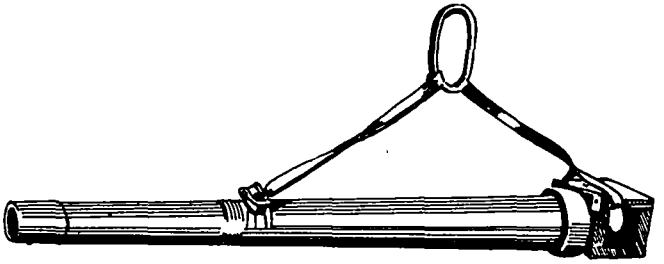

Figure 11. Tube prepared for type A load.

(*a*) The No. 5 cannoneer holds the nylon ring with two attached straps.

(*b*) One extra cannoneer threads end with large loop through the breech recess, then passes small end loop through the larger loop to form a slip knot above the breech recess. The assistant gunner runs the other strap around the muzzle end of the tube at the bearing surface located behind the barrel locking ring threads. The extra cannoneer takes a clevis and inserts it on the front strap, placing the loop in the jaws of the clevis, inserts the clevis pin so that it passes through the loop (small), and secures.

b. Reassemble—Type A Load. Procedures outlined in *a* above are executed in reverse order. It

is imperative that all mechanisms be scrutinized for possible damage and dirt which may render the weapon unsafe to use.

c. Disassembly—Type B Load.

(1) Same as *a*(1) and (2) above.

(2) No. 5 cannoneer removes the recoil piston rod outer locking nut.

(3) Same as *a*(4) above except that six cannoneers from an alternate howitzer section will assist in the removal of the tube and recoil mechanism as a single intact unit. This is accomplished by introducing a third lifting bar and utilizing nylon straps which are wrapped around the tube at the muzzle end and around the recoil mechanism at the center of the piece. The third lifting bar is inserted through the breech for carrying.

(4) Same as *a*(5) through (8) above (figs. 12 and 13).

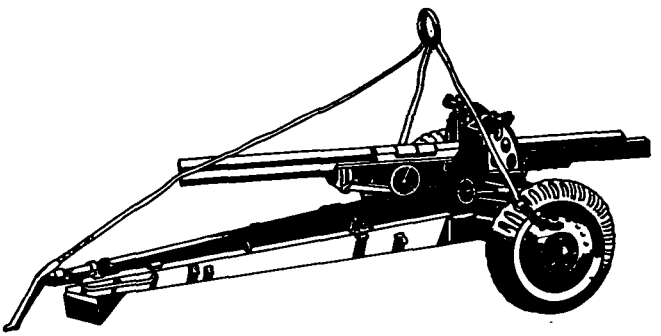

Figure 12. Carriage prepared for type B load.

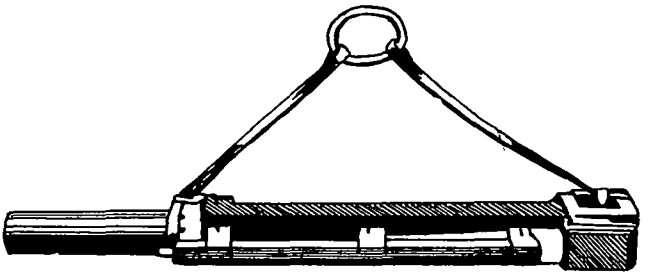

Figure 13. Tube and recoil mechanism prepared for type B load.

d. Reassembly—Type B Load. Procedures outlined in *c* above are executed in reverse order.

e. Hookup Procedure.

(1) The gunner positions himself in front of carriage, and, by signals, directs the helicopter to a hovering position directly over the load. No. 4 places the nylon ring in the helicopter cargo hook. During night hookup an additional cannoneer may be positioned at the right side of the helicopter to relay signals to the gunner.

(2) After carriage is lifted the gunner and No. 4 man move to the howitzer tube loading point and repeat the hookup process. Section personnel and their equipment are loaded into the helicopter while the tube is being hooked up and are transported to the position area internally.

CHAPTER 4
TECHNIQUES AND SITUATIONS THAT REQUIRE SPECIAL ATTENTION

28. Precision in Laying

a. Fire control instruments, fuze setters, and elevation and traverse mechanisms must be operated to reduce the effects of lost motion.

b. The gunner and assistant gunner will verify the laying after the breech has been closed.

c. For uniformity and accuracy—

(1) The line of sight for setting and reading a scale or centering a bubble should be at a right angle to the scale or level vial to prevent parallax errors.

(2) The vertical reticle of the panoramic telescope is alined with the left edge of the aiming posts.

29. Aiming Points

After the howitzer has been laid for direction, it is referred to a primary aiming point, normally the aiming posts and alternate aiming points (distant aiming points) as required.

a. An aiming point must be a sharply defined point, or a clearly visible vertical line.

b. Alternate aiming points (distant aiming points) must be at least 2,000 meters distant. This

distance prevents displacement in firing or traverse from causing more than a ½ mil horizontal change in direction with the same settings on the scales.

c. The aiming posts are placed in alinement with the vertical reticle of the panoramic telescope as directed by the gunner.

(1) The *far* aiming post is placed at least 100 meters from the piece. This distance is the most desirable for accuracy, visibility, and control of the aiming post lights.

(2) The *near* aiming post must be set up halfway between the far post and the piece. Equal spacing is accomplished either by pacing, or by measuring with the panoramic telescope and using the aiming post as a stadia rod or by using a wire or cord with the appropriate distances marked in a convenient manner.

(3) If the aiming post is used as a stadia rod, the procedure is as follows:

(*a*) Number 4 stands at the far aiming post and holds the upper section of an aiming post parallel to the ground and perpendicular to the line of sight.

(*b*) The gunner measures the length of the aiming post in mils on the reticle of the panoramic telescope.

(*c*) The gunner directs number 4 to move toward the piece and to emplace the near aiming post at a point where the

upper section measures twice the number of mils it measured at the far aiming post.

(4) For night use, the light on the far aiming post should be placed so that it appears several feet above the light on the near aiming post. The lights placed in this manner establish a vertical line for laying the howitzer.

(5) Unit SOP will specify the deflection at which to place the aiming posts; however, placing the aiming posts at deflection 2800 reduces misalinement and allows for maximum visibility.

(6) Correction for displacement of the aiming posts from the vertical reticle of the panoramic telescope is discussed in table II.

30. Changes in Data During Firing

If it is necessary to change any element of firing data, the executive commands CORRECTION.

a. Piece unloaded. Set off new data and resume firing when the quadrant is announced.

b. Piece loaded. Set off new data and resume firing when the quadrant is announced if no change is required in the fuze, time setting, or charge.

(1) If the data requires a change in the fuze, time setting, or charge, the chief of section will suspend firing and report to the executive, "Number 2 loaded, charge

( ), fuze ( ), time ( )," stating the elements that are changed.

(2) In continuous fire, changes in data are applied without stopping the fire or breaking its continuity.

31. To Unload the Howitzer

a. Once a completed round is loaded, it should be fired. However, if unloading is required, the command is UNLOAD.

b. If the howitzer has been fired repeatedly and the tube is heated, it should be fired if possible; or if necessary, unload the weapon as quickly as possible.

c. Unloading will be supervised by an officer and the procedure is as follows:

(1) The assistant gunner opens the breech slowly.

(2) Number 1 standing at the breech, receives the ejected round.

d. If the extractor fails to eject the cartridge case, the procedure is as follows:

(1) Number 2 obtains the rammer staff and the unloading rammer head.

(2) The officer inspects the rammer head to insure that it is free from obstruction.

(3) Number 2 inserts the rammer into the bore until the head incloses the fuze and touches the projectile.

(4) Number 2 then pushes on the rammer, and taps the end of the staff lightly with a wooden block if necessary, until the round is dislodged.

(5) Number 1 receives the round as it is pushed out of the breech.

e. If the cartridge case is extracted but not the projectile, the procedure is as follows:

(1) Number 1 fills the chamber with waste and closes the breechblock.

(2) Number 2 dislodges the projectile as in *d* above.

(3) Number 1 opens the breech, removes the waste and receives the projectile as number 2 pushes the projectile to the rear.

32. Care of Ammunition

To insure uniform results in firing, to prolong the life of the tube, and to avoid accidents, great care must be exercised in handling and storing ammunition. The following requirements should be met:

a. Information contained in TM 9–1900 that are applicable to field service should be followed.

b. Protect the ammunition from damage.

(1) Leave in containers until just prior to firing.

(2) Use tarpaulins and dunnage to protect ammunition against weather, dirt, and sun.

(3) Raise ammunition stacked in the open 6 inches off the ground, and dig drainage ditches around the stacks.

(4) Allow 6 inches air space between the top of the stack and the covering tarpaulin.

Note. Uniform propellant temperatures must be maintained to provide accurate firing.

c. Explosive elements in fuzes are particularly sensitive to shock and high temperature. The precautions to be observed are as follows:

(1) Protect from weather, direct sunlight and rough handling.

(2) Remove protection and safety devices from fuzes just prior to their use.

(3) Do not attempt to disassemble a fuze.

d. Protection against hostile fire may be accomplished by—

(1) Dispersing ammunition in small stacks.

(2) Store ammunition in trenches and dugouts.

(3) Insure that each stack of ammunition does not contain more than 75 rounds, is not more than four layers high.

(4) Placing stacks of ammunition at least 10 meters apart.

e. Ammunition should be sorted into lot numbers as it is stored.

f. For further information on care of ammunition, see FM 6–40, TM 9–325, TM 9–1300–203, and TM 9–1900.

CHAPTER 5
BORESIGHTING

Section I. GENERAL

33. Description

Boresighting is—

a. The process to *verify,* and *aline* if required, that the optical axis of the panoramic telescope and the elbow telescope is parallel to the axis of the tube in deflection and elevation.

b. Conducted prior to firing and, when necessary, during lulls in firing.

c. Performed to insure accuracy in laying for elevation and direction.

34. Methods of Boresighting

a. The methods of boresighting this howitzer are:

(1) Testing target method (par. 36–38).
(2) Distant aiming point method (par. 39–41).
(3) Standard angle method (par. 42–44).

b. The method of boresighting to be used will be determined by the unit SOP and the time available.

35. Equipment

The equipment that is needed for boresighting is described below:

a. Front and Rear Boresight.

(1) Front and rear boresights are used to aline the tube on the testing target or distant aiming point.

(2) If boresights are not available, crosshairs are fastened to the muzzle and the firing pin hole in the breechblock bushing is used as the rear sighting guide by removing the firing lock from the breechblock.

b. Testing Target. The testing target provides accurate aiming diagrams for the tube, the panoramic telescope, and the elbow telescope in boresighting and testing. The testing target is prepared as follows:

(1) Mount the testing target on a flat piece of material and fasten it to a stand to provide stability (fig. 14).

(2) Install a blumbline and mil scale for use in leveling or canting the target (fig. 14).

(3) Draw vertical reference lines for use when the trunnions are not level. The testing target must be canted an equal amount and in the same direction (fig. 14).

(4) To facilitate boresighting in darkness, bore $\frac{1}{16}$-inch hole through the center of each aiming diagram and cover each hole with a piece of heavy cloth. A flashlight is held against the material to provide an aiming point for blackout conditions.

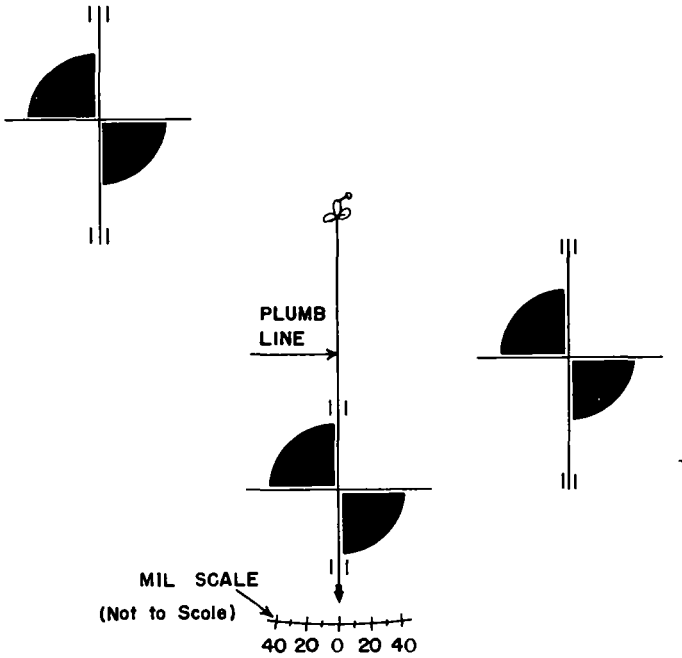

Figure 14. Testing target.

c. Tools. Section equipment includes all necessary tools for boresighting and testing.

Caution: **Use the proper tools to prevent damage to fire control equipment.**

d. Plumbline. The plumbline is used to level the trunnions for testing and to boresight the howitzer if time is not a factor. The plumbline is prepared as follows:

(1) Suspend the line from any convenient location so that the muzzle of the howitzer can be placed at a distance of approximately 5 feet from the line. For a more complete test insure that the line is long enough to allow for the highest possible tube elevation.

(2) Attach a weight to the end of the line for tautness and, to prevent the line from swinging, place the weight in a liquid filled container.

Section II. TESTING TARGET METHOD

36. General

The testing target method consists of alining the line of sight of the tube, panoramic telescope, and the elbow telescope with the aiming diagrams on the testing target.

37. Preparations for Boresighting

Preparations for boresighting are as follows:

a. Place the howitzer on level ground.

b. Place the tube in the center of traverse.

c. Install the front and rear boresights (par. 35*a*).

d. Level the trunnions by using a plumbline, a gunner's quadrant, or matching the scribed lines on the telescope mount. The plumbline method is preferable, and the procedure is as follows:

(1) Install a plumbline (par. 34*d*).

(2) Traverse the tube until the plumbline is alined with the front and rear boresights.

(3) Elevate and depress the tube throughout its limits. The vertical hairline of the front boresight should remain in coincidence with the plumbline.

(4) If coincidence is not maintained, raise one of the trails until the vertical hairline on the muzzle does track the plumbline.

(5) Perform steps in (3) and (4) above until coincidence is maintained throughout the elevation limits. Block the raised trail to make it solid. The trunnions are now solid.

e. The gunner's quadrant will normally be used to level the trunnions under field conditions when time is critical. The procedure is as follows:

(1) Use gunner's quadrant that has been checked by the end-for-end test.

(2) Set the index arm and the micrometer scale on the quadrant at zero.

(3) Place the quadrant in the breech recess parallel to the trunnions.

(4) Raise one trail until the bubble on the gunner's quadrant is centered.

f. If a plumbline or a gunner's quadrant is not available, match the white scribed lines on the telescope mount and raise one trail until the telescope mount cross-level bubble is centered. The scribe lines are scribed after a basic periodic test.

g. Set the tube at zero elevation by using a gunner's quadrant and applying corrections, as determined from the end-for-end test.

h. Center the longitudinal- and cross-level bubbles of the panoramic telescope mount.

38. Boresighting Procedures With Testing Target

With the weapon prepared as in paragraph 37, boresight as follows:

a. Testing Target Location. Locate testing target at least 50 meters in front of the howitzer.

b. Testing Target Alinement. Without moving the tube, aline the center aiming diagram of the testing target with the line of sight through the tube. The testing target must be placed perpendicular to the axis of the bore. *The testing target must then be made secure.*

c. Panoramic Telescope and Mount Alinement.

(1) Check the tangent screws for a firm sliding fit.

(2) Set the azimuth scale on the panoramic telescope to zero by turning the micrometer knob.

(3) Set the azimuth micrometer scale to zero (loosen the micrometer locking nut and slip the scale to zero, if necessary). The left index must also coincide. Tighten the micrometer locking nut.

(4) Loosen the tangent screw lockscrews and with the tangent screws bring the vertical hair into alinement with the aiming diagram of the test target. Tighten the tangent screw lockscrews. Recheck the scales and the fit of the telescope in the mount.

(5) Turn the elevation micrometer knob so that the horizontal crosshairs of the reticle of the telescope are on the appropriate aiming diagram of the testing target. The elevation micrometer scale should read zero. If it does not, loosen the screws on the knob, hold the knob, and slip the scale to zero. Tighten the screws. Only ordnance is authorized to adjust the coarse (azimuth) indexes.

(6) Match the elevation indexes on the sight mount by loosening the screws on the movable elevation index and the nut on the longitudinal-leveling knob (elevation knob). Tighten the screws and recheck.

d. Range Quadrant Adjustment.

(1) Set the elevation scale at zero by turning the elevation knob.

(2) The elevation micrometer scale should read zero. If the elevation micrometer does not read zero, loosen the three screws in the knob and, without moving the knob, slip the zero of the micrometer scale into coincidence with the index. Tighten the screws and recheck.

(3) Level the cross-level bubble.

(4) With the angle of site knob, level the longitudinal-level bubble.

(5) Check the angle of site scale. It should read 3 (300). If the angle of sight scale does not read 3 (300), loosen the two screws on the scale and move the digit

3 into coincidence with the index. Tighten the screws and recheck.

(6) Check the angle of site micrometer scale. It should read zero. If the angle of site micrometer scale does not read zero, loosen the screw in the micrometer knob and, holding the knob so as to keep the bubble centered, move the zero into coincidence with the index. Tighten the screw and recheck.

(7) Recheck both bubbles, all scales, and indexes.

(8) When the adjustment is complete, both bubbles are centered and all scales are at zero except the angle of site scale which should read 3 (300).

e. Adjustment of the Elbow Telescope.

(1) Level the reticle to the field of view with the bracket rotating knob.

(2) The N reticle line should be on its aiming diagram on the testing target.

(3) If the N reticle line is not set correctly—

(*a*) Loosen the worm clamping bolt.

(*b*) Move the elevation adjustment worm to bring the N line to coincidence with the aiming diagram on the testing target.

(*c*) Tighten the worm clamping nut and recheck.

Note. No adjustment can be made for deflection.

Section III. DISTANT AIMING POINT METHOD OF BORESIGHTING

39. General

The distant aiming point method consists of alining the line of sight of the tube, the panoramic telescope and the direct fire telescope on an aiming point at a distance of at least 2,000 meters. This distance is used to insure that the mechanical axis of the tube and the optical axis of the telescopes intersect to form an angle not greater than one-fourth mil and are thereby approximately parallel.

40. Preparations for Boresighting

Preparations for boresighting are as follows:

a. The weapon should be near its center of traverse and pointed in the general direction of the distant aiming point.

b. Accurate cross-leveling of the trunnions is unnecessary for boresighting on a distant aiming point; however, they should be as level as possible.

c. The breech and muzzle boresights must be in their proper positions.

d. All instruments and mounts must be positioned securely without free play.

e. Set the tube at zero elevation by performing the end-for-end test on the gunner's quadrant.

f. Level the telescope mount by centering the cross- and longitudinal-level bubbles or by matching scribe lines on mount. Lock the elevation movement by tightening the wingnut. In this

position, the coarse and the fine set of elevation indexes must coincide. If they do not, make the following adjustment:

(1) Loosen the two retaining screws on the adjustable coarse index and aline the two coarse indexes.

(2) Loosen the retaining nut on the elevation knob and slip the index ring to aline the two fine indexes.

(3) Tighten the two screws and the nut and verify the adjustment.

Note. The coarse and fine sets of elevation indexes must be in coincidence at all times during the boresighting operation.

g. Adjust the range quadrant as follows:

(1) Cross-level the range quadrant and set the elevation and micrometer scales to zero.

(2) Set the angle of site scale to 3 (300) and the angle of site micrometer scale to zero. In this position, the longitudinal-level bubble must center. If it does not, center the bubble by means of the angle of site micrometer knob.

(3) Loosen the two retaining screws on the angle of site scale and slip the scale to aline the "3" with the angle of site scale index.

(4) Loosen the screw in the angle of site micrometer knob and slip the angle of site micrometer scale to aline the zero with the micrometer scale index.

(5) Check to insure that the longitudinal bubble is still centered.

(6) Tighten the screw in the angle of site micrometer knob and the two retaining screws on the angle of site scale and verify the adjustment.

41. Boresighting Procedures, Distant Aiming Point

a. While looking through the breech boresight, elevate and traverse the tube until the intersection of the crosshairs of the muzzle boresight is alined on the distant aiming point.

b. Adjust the panoramic telescope as follows:

(1) Check to insure that the azimuth and micrometer scales are set at zero.

(2) Adjust the vertical line in the reticle of the telescope on the distant aiming point by means of the tangent screws.

(3) The boresight picture observed in the telescope must be the same as the sight picture observed through the tube.

(4) Adjust the horizontal line on the distant aiming point by means of the elevating knob on the telescope. If the fine indexes do not coincide, loosen the three screws on top of the elevating knob and slip the scale. Tighten the three screws and verify the adjustment. Adjustment of the coarse index by battery personnel is *not* authorized.

(5) The panoramic telescope should be removed from the sight mount and then replaced to determine if there is any

looseness in the seating or if the tangent screws have been adjusted too tightly. This operation may reveal that the tangent screws must be readjusted to bring the line of sight on the distant aiming point.

c. Adjust the elbow telescope as follows:

(1) If the reticle pattern appears tilted in relation to the terrain, turn the rotating knob on the telescope mount until the range lines are parallel to the horizon.

(2) If the N range line on the elbow telescope is not alined with the distant aiming point, loosen the elevation worm clamping bolt on the telescope mount and turn the elevation worm to bring the N range line of the elbow telescope in coincidence with the aiming point; tighten the clamping bolt and verify the adjustment.

(3) This mount does *not* provide for any lateral adjustment.

Section IV. STANDARD ANGLE METHOD OF BORESIGHTING

42. General

When positions are occupied in combat, the necessity for speed in opening fire or the necessity for observing camouflage discipline may make the boresighting methods previously described impracticable. Under such circumstances, the alinement of the optical axis of the panoramic telescope

parallel to the axis of the bore may be tested and adjusted by referring to a selected point on the muzzle. The deflection and elevation angles necessary to refer the line of sight of the telescope to the selected point of the muzzle will be referred to as the standard angles. During the basic periodic test, when the panoramic telescope has been found to be in correct alinement, is an ideal time to establish standard angles for later use. Once they have been determined, they may be used for a quick test of the alinement of the panoramic telescope when more precise methods cannot be used. Misalinement discovered and corrected as a result of this test should be verified by a more accurate method at the earliest opportunity. When using the standard angle method of boresighting, be sure that the position of the recoiling parts with respect to the nonrecoiling parts is the same as when the standard angles were determined. Because of this, the recoil system must be checked to see that it contains the proper amount of recoil oil before determining the standard angle.

43. Preliminary Operations

The procedure for establishing standard angles is as follows:

a. With the tube in battery, scribe lines in the paint to mark the position of parts which move in recoil with respect to parts which do not move in recoil.

b. Carefully level the trunnions.

c. Boresight the gun using a testing target.

d. With adhesive tape, fasten a bright common pin in the left horizontal witness mark. Allow the pin to project to the left of the muzzle.

e. Fasten a telescope parallax shield in place over the eyepiece.

f. Verify that the elevation index and the micrometer on the telescope are at zero.

g. Elevate the tube until it is approximately level with the top of the panoramic telescope.

h. Center the bubbles of the telescope mount and refer the telescope to the junction of the pin with the muzzle. Adjust the tube elevation and turn the azimuth micrometer knob until, with the bubbles centered, the horizontal and vertical hairs of the telescope are exactly on the junction of the pin with the muzzle.

i. Read the angle from the panoramic telescope to the nearest one-fourth mil. Since the graduations are to the nearest mil it is necessary to interpolate to the nearest one-fourth mil. This is the standard azimuth (horizontal) angle for the gun tested.

j. With either the range quadrant or gunner's quadrant, measure the elevation of the tube to the nearest one-fourth mil. This is the standard elevation (vertical) angle for the gun tested.

k. With a knife blade or other sharp metal point, scribe lines in the paint on the following parts:

(1) Straight across the junction of the cross-leveling segment and the cross-leveling worm knob (3, fig. 15).

(2) Straight across the junction of the cross-leveling worm housing and the cross-leveling worm knob shaft (2, fig. 15).

(3) Straight across the junction of the rocker and the actuating arm (1, fig. 15 and 2, fig. 16).

(4) Straight across the junction of the elevation knob shaft and the bracket (1, fig. 16).

l. Fill the scribed lines with red paint and wipe off the excess.

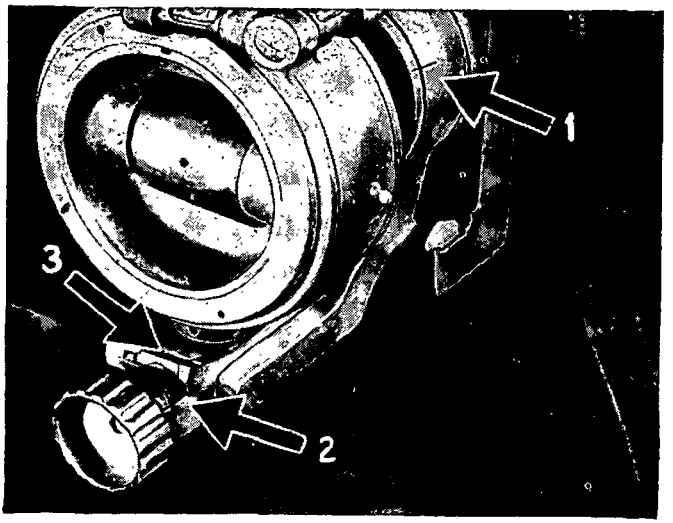

Figure 15. Scribe lines for positioning mounts both laterally and longitudinally.

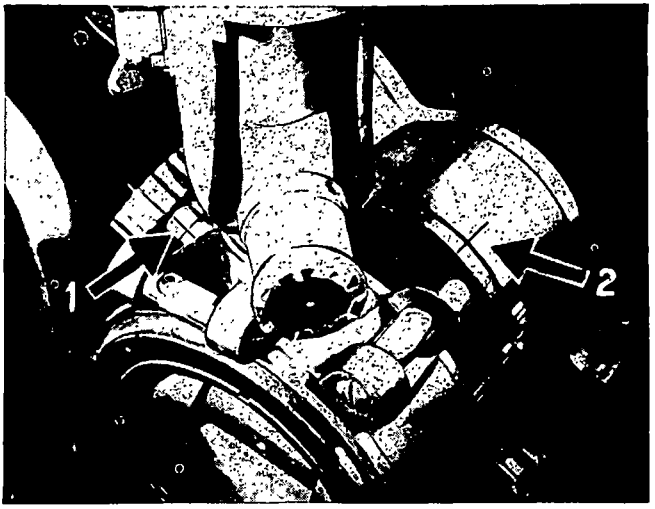

Figure 16. Scribe lines for positioning mount longitudinally.

44. Procedure for Checking in the Field

Once the standard angles have been determined, steps in performing the standard angle method of boresighting are as follows:

a. Verify that the parts that move in recoil are in the same position with respect to the nonrecoiling parts as they were when the standard angles were determined.

b. Verify that the trunnions are canted not more than 10 mils; if convenient, level the trunnions.

c. Using the range quadrant or gunner's quadrant, elevate the tube to the standard elevation angle.

d. Place the parallax shield on the eyepiece of the telescope.

e. Make sure that the red scribe lines are in coincidence and set off the standard azimuth angle on the panoramic telescope.

f. Place pin in left witness mark.

g. If the vertical reticle is not exactly on the junction of the pin and the muzzle, adjust the tangent screws until the vertical reticle is properly alined.

h. If the horizontal reticle is not exactly on the junction of the pin and the muzzle, turn the elevating knob of the panoramic telescope until it is properly alined. Adjust the zero of the elevation knob scale so that it is in alinement with the index.

CHAPTER 6
BASIC PERIODIC TESTS

Section I. GENERAL

45. Purpose

Basic periodic tests are performed—

a. To determine whether the on-carriage sighting equipment, the gunner's quadrant, and the fuze setter are in correct adjustment.

b. By the section and the artillery mechanic under the supervision of the battery executive.

c. At the discretion of the unit commander. Suggested times are—

(1) Once each year if howitzer is used for nonfiring training.
(2) Every 3 months if the howitzer is fired.
(3) As soon as possible after intensive use, accidents, or travel in extremely rough terrain.

46. Conditions for Correct On-Carriage Fire Control Adjustment

The following conditions must be met for correct adjustment of on-carriage fire control instruments:

a. The line of sight of the panoramic telescope and of the elbow telescope must be parallel to the axis of the bore.

b. All indexes and scales, except the angle of sight scale, must read zero. The angle of site scale must read 3 (300).

c. All bubbles must be in adjustment and level.

47. Preparations for Basic Periodic Tests

The following conditions must be established prior to conducting the tests:

a. Place the howitzer on a site that is as near level as possible.

b. Suspend a plumbline (par. 35*d*).

c. Level the trunnions by using the plumbline.

d. Boresight the howitzer by using the testing target.

Section II. TESTS OF GUNNER'S QUADRANT

48. General

The gunner's quadrant *must* be in proper adjustment to conduct the tests and adjustments on other sighting and fire control equipment.

49. End-For-End Test

The end-for-end test is conducted as follows:

a. Inspect the shoes on the gunner's quadrant for dirt, nicks, and burrs.

b. Inspect the quadrant seats on the breech for dirt, nicks, and burrs.

c. Zero the scales on the gunner's quadrant.

d. Place the quadrant on the quadrant seats. Depress and elevate the tube until the bubble in the gunner's quadrant is centered.

e. Reverse the quadrant on the seats and check the bubble. If the bubble recenters, the quadrant is in adjustment, and the test is complete.

f. If the bubble does not center, turn micrometer knob and try to center the bubble.

(1) If the bubble centers, read the black figures on the micrometer scale and divide by 2. *This is the correction for the gunner's quadrant.*

(2) Place this correction on the micrometer scale, and level the tube.

(3) Reverse the quadrant. The bubble should center.

g. If the bubble does not center as in *f* above, move the gunner's quadrant arm down one graduation (10 mils).

(1) Turn the micrometer knob until the bubble centers.

(2) Take the reading on micrometer scale, add 10 to it and divide the sum by 2. Place the result on the micrometer scale.

(3) With the quadrant arm set at minus 10 and the above result on the micrometer scale, place the quadrant on the quadrant seats and level the tube.

(4) Reverse the quadrant. The bubble should center.

(5) Subtract the reading on the micrometer scale from 10 to obtain the error.

Note. If an error is determined during the end-for-end test, it will be used only during the sighting tests and adjustments and will not be carried in fire missions. If the error exceeds 0.4 mil the quadrant must be sent to ordnance.

50. Micrometer Test

The micrometer test is performed as follows:

a. Set the radial arm to read 10 mils on the elevation scale, and set the micrometer at zero.

b. Place the quadrant on the leveling plates with the line-of-fire arrow pointing toward the muzzle, and center the quadrant bubble by elevating the tube.

c. Set the radial arm at zero, and set the micrometer at 10 mils.

d. Reverse the quadrant; the bubbles should center.

Note. Do not disturb the lay of the tube.

e. If the bubble does not center, the *micrometer* is in error and must be adjusted by ordnance personnel.

51. Comparison Test

The comparison test is conducted in the following manner:

a. Compare the readings as follows:

(1) Take readings at low, medium, and high elevations.

(2) Use *each* gunner's quadrant in the battery.

(3) Use the leveling plates of a *single* piece.

b. Compute the average reading at each elevation.

c. Compare *each* quadrant reading with the average.

d. Any quadrant differing more than 0.4 mil from the average must be adjusted by ordnance personnel.

Section III. TESTS OF ON-CARRIAGE FIRE CONTROL EQUIPMENT

52. Test of Range Quadrant

a. Cross-Level Tests.

(1) The howitzer and carriage being level (axis of bore and axis of trunnions), center the cross-level bubble.

(2) Turn the elevation knob throughout its limits of motion.

(3) The cross-level bubble should remain centered to within one-half vial graduation; if it does not, the level is incorrectly alined and the weapon should be sent to an ordnance unit for adjustment.

b. Pivot Azimuth Alinement Test.

(1) Place the breech and muzzle boresights in their proper positions in the tube.

(2) Center the previously tested cross-level bubble.

(3) Elevate and depress the tube, checking to see that the boresights track a plumb line placed in front of the tube; at the same time, watch the cross-level bubble.

(4) The bubble should remain centered to within one-half vial graduation.

(5) If the bubble moves off center in excess of this amount, the pivot is not alined in azimuth with the tube; send the weapon to an ordnance unit for adjustment.

c. *Pivot Vertical Alinement Test.*

(1) Level the tube using the previously tested gunner's quadrant.

(2) Center the longitudinal bubble by turning the angle of site micrometer knob.

(3) Operate the cross leveling knob throughout the limits of the motion; the longitudinal-level bubble should remain centered.

(4) If the bubble moves off center in excess of one-half vial graduation, either the pivot is not alined vertically with the tube or the level vial is not correctly alined; send the weapon to an ordnance unit for adjustment.

d. *Comparison Test.*

(1) Compare the readings indicated by the gunner's quadrant with those on the elevation quadrant at low, medium, and high elevations of the tube.

(2) If the two instruments do not agree at all elevations, send the weapon to an ordnance unit for adjustment.

e. *Angle of Site Scale Test.* Level the tube with the gunner's quadrant, cross-level the range quadrant, and set the scales at zero. Center the longitudinal-level bubble by turning the angle of site micrometer knob. The angle of site scale should read 3 (300) and the angle of site micrometer should read zero; if they do not, adjust the scales.

53. Test of Azimuth Compensating Mechanism Panoramic Telescope Mount

a. *General.* The purpose of this test is to

determine whether the azimuth compensating mechanism of the telescope mount actually keeps the tube in the correct vertical plane at all elevations. One of the tests listed below, in order of preference, should be performed.

b. Test Wherein Trunnions Need Not Be Level (Plumbline Required). By using a plumbline as a vertical reference plane, this test reveals the total amount of error that exists between the center of the reticle pattern and the direction in which the tube points. Steps are as follows:

(1) With boresights in place and tube near zero elevation, traverse so that the line of sight through the tube is on the plumbline.

(2) With the sight mount leveled, move only the sight to refer to a distant sharply defined aiming point (in any direction). Use the elevation knob of the sight to bring the horizontal reticle to the aiming point.

(3) Elevate the tube to maximum elevation or to the top of the plumbline. Traverse, if necessary, to bring line of sight through tube back to plumbline.

(4) Level the panoramic telescope mount both laterally and longitudinally.

(5) Sight through the telescope to determine whether or not it is still on the aiming point.

(6) If the sight is off the aiming point in excess of 1 mil in deflection and/or one-half vial graduation in elevation, send

the weapon to an ordnance unit for adjustment.

c. Test With Trunnions Level. Using the leveled trunnions and tube for control this test determines whether errors exist in the actuating arm pivot and/or level vials. Leveling may be accomplished by a plumbline check or by cross-leveling with the gunner's quadrant on the breech ring. If cross-leveling is accomplished with the gunner's quadrant on the breech ring, results of the test are accurate only to the extent of the parallel relationship of the trunnions to the top surface of the breech ring. Steps are as follows:

(1) *Cross-level test of telescope mount.* The telescope mount cross-level bubble must be in proper adjustment before conducting the remainder of this test of the azimuth compensating mechanism.

(*a*) Center the cross-level bubble and place the line of sight of the panoramic telescope on a sharply defined aiming point.

(*b*) Elevate the tube to maximum elevation while keeping the telescope mount level longitudinally.

Note. Do not readjust the cross-level bubble after the initial setting.

(*c*) The line of sight must not deviate from the target by more than 1 mil at any elevation checked nor the cross-level bubble travel more than one-half vial graduation. If deviation in excess of the tolerance occurs, the level vial

or pivot is incorrectly alined; send the weapon to an ordnance unit for adjustment.

(2) *Vertical alinement test of telescope mount*

(*a*) Level the tube longitudinally with the gunner's quadrant.

(*b*) Center the longitudinal-level bubbles.

(*c*) Operate the cross-leveling knob throughout the limits of motion; the longitudinal-level bubble should remain centered within one-half vial graduation. If the bubble moves in excess of the tolerance, either the level vial or the actuating arm pivot is not alined correctly and the weapon should be sent to an ordnance unit for adjustment.

d. Test With Gunner's Quadrant on Socket. Using the top surface of the socket for control this test determines the relationship of the level bubbles to the top surface of socket. If the socket is bent or if the top surface is unlevel, results of the test will be inaccurate. With the tube and trunnions approximately level, place a steel or glass plate having parallel sides on top of the telescope mount. Level the telescope mount both crosswise and longitudinally by turning the cross-leveling and elevation knobs, using the tested gunner's quadrant as a level. If the elevation indexes on the rocker and the actuating arm and those on the elevation knob and the shaft do not match, adjust them by moving the adjustable in-

dex on the rocker or by adjusting the elevation knob index as needed. If the cross- and longitudinal-level bubbles are not centered within one-half vial graduation, adjustment must be made by ordnance personnel.

Section IV. TEST OF FUZE SETTERS

54. General

Examine the fuze setters as follows:

a. Check for burred or dented edges—

(1) The stop that fits into the slot of the movable time ring.

(2) The adjusting pawl which engages the notch in the fixed fuze ring.

b. Depress the adjustable pawl against its spring to determine that the movement of the pawl is free.

c. Test the fuze setter with the fuze for which it was designed; the time scale on the fuze setter must have the same graduation as the time ring on the fuze.

55. Time Scale Test

The time scale test is performed to verify that the time set on the fuze agrees, within prescribed tolerances, with the time setting on the fuze setter. This test may be conducted during firing or as a separate test.

Warning: **Never use a fuze from a dud.**

a. The time set on the fuze should agree with the time setting on the fuze setter within one-

fourth of the smallest graduation on the fuze time ring. The tolerances are—

(1) 0.05 second for fuzes having 0.2 second graduation.

(2) 0.125 second for fuzes having 0.5 second graduations.

b. If a fuze setting doesn't agree with the time set on the fuze setter proceed as follows:

(1) Repeat the test as a check with a different setting.

(2) If the fuzes and the fuze setter still don't agree, refer the instrument to ordnance.

c. Do not set any one live fuze more than twice.

d. When tests are complete, reset all fuzes to SAFE and replace the safety wire or cotter pin.

CHAPTER 7

MAINTENANCE AND INSPECTIONS

56. General

Systematic maintenance and inspection are essential to insure that—

a. The howitzer section is prepared to carry out its mission immediately.

b. Unexpected breakdowns are not experienced at a critical time when maximum performance is essential.

c. Expensive and time-consuming repairs are reduced to a minimum.

57. Disassembly, Assembly, and Adjustment

Authorized adjustments and disassemblies to be performed by battery personnel are prescribed in TM 9–325, and appropriate Department of the Army supply manuals. Deviation from these procedures is not authorized, except as permitted by the responsible ordnance officer.

58. Records

The principal records pertaining to the weapon are the equipment log book, DA Form 2404 (Equipment Inspection and Maintenance Worksheet) and DA Form 2407 (Maintenance Request). For detailed information on the use of these forms, see TM 38–750.

59. Maintenance

Detailed instructions for maintaining the howitzer are contained in TM 9–325 and LO 9–325. Maintenance instructions for the prime mover are contained in the appropriate technical manuals and lubrication orders.

60. Inspection

a. The chief of section should inspect his equipment *daily* and take immediate action to correct any deficiencies found.

b. The executive, accompanied by the artillery mechanic, should make a *daily informal command inspection* on *different* parts of the weapon and carriage.

c. The executive should make a thorough mechanical inspection *at least* once a month of the weapons, auxiliary equipment, tools, and spare parts.

61. Operational Services

A daily service is performed by the crew *each day* the vehicle or weapon is *operated.* This service is divided into three parts.

a. Before-operation service is a brief service to determine if the vehicle and howitzer is ready for operation. At this time the chief of section verifies that sufficient ammunition, rations, tools, and equipment are available and secured. A detailed list of duties is contained in table VI.

Table VI. Before-operation Service
(Located in back of manual)

Table VII. During-operation Service
(Located in back of manual)

b. During-operation service consists of detecting any unsatisfactory performance of the vehicle or howitzer. A detailed list of duties is contained in table VII.

c. After-operation service prepares the vehicle to operate again on a moment's notice. This is the basic daily service for the vehicle, and howitzer and it is particularly important to detect deficiencies that developed during operation. All defects that the driver and crew cannot remedy must be reported at this time. The chief of section will resupply, as required, ammunition and rations and verify that all equipment is present. A detailed list of duties is contained in table VIII.

Table VIII. After-operation Service
(Located in back of manual)

CHAPTER 8
DECONTAMINATION OF EQUIPMENT

62. General

a. Equipment that has been contaminated with the following agents constitutes a hazard to personnel and must be removed or neutralized:

(1) Chemical.

(2) Biological.

(3) Radiological.

b. Decontamination is the process of covering, removing, destroying, or changing the contaminating agent or agents into harmless substances.

c. Decontamination must be started as soon as possible in order to reduce hazards and allow safe operation of equipment.

63. Decontamination of Toxic Chemical Agents

Table IX prescribes the methods for decontaminating toxic chemical agents.

Table IX. Decontamination for Toxic Chemical Agents

Contaminated object	Preferred decontamination methods	Alternate decontamination methods	Field expedient methods
Canvas	Boil in soapy water for 1 hour. Use 5 percent solution of household bleach for V-agents. Use 5 percent solution washing soda for G-agents.	Immerse in boiling water for 1 hour. Launder by standard methods. Use DANC[1] solution or DS2.[1] Use slurry.[2]	Aerate (except for V-agents).
Clothing	Immerse in boiling water for 1 hour, stir, add 1 pound of soap to each 10 gallons of water. Use 5 percent solution of bleach for V-agents. Use 5 percent solution of washing soda for G-agents.	Launder by standard methods. Dryclean. Use DS2 for cotton items only.	Rub M5 ointment on small contaminated areas. Aerate (except for V-agents).
Unpainted metals	Use DS2 or DANC, then rinse or wipe with organic solvent,[3] and dry.	Wash with *cool* soapy water[3] and rinse.	Aerate.

Painted metals ---	Spray with DS2 or DANC solution.	Wash with hot soapy water and rinse. (Slurry may be used if it is removed within 1 hour and the surface is oiled.)	Aerate.
Instruments ------	Clean with alcohol (or gasoline) and apply a thin coat of oil.	Wipe with rag dampened with DANC or DS2, dry with clean rag, and oil.	Weather.

[1] These decontaminants are injurious to plastic and hard rubber and should not be used in the bore.

[2] Equal weights of water and chloride of lime.

[3] Organic solvents (petroleum products) and water do not neutralize contaminants. Precautions must be taken to dispose of these solvents as contaminated materiel.

64. Decontamination of Biological Agents

Decontaminants and decontamination procedures for toxic chemical agents are usually effective against biological agents.

65. Decontamination of Radiological Agents

a. Radioactive contaminants cannot be made safe by chemical action. They must be removed or shielded if it is impracticable to wait for natural decay.

b. Decontamination is the process of *reducing* the hazard by removing the contaminant or shielding against radiation. Methods are given in table X.

Table X. Decontamination for Radiological Agents

Method	Contaminated object	Technique	Remarks
Wash and scrub with water.	All nonporous surfaces (metal, paint, plastics).	Work from top to bottom and up wind.	Drainage must be controlled —water is contaminated.
Detergent (soap) solution.	All nonporous surfaces.	Heat water if possible. Rub surface and wipe dry. (Moist application is all that is desired, do not let drip.)	Rags and runoff require disposal.
Organic solvents. (Petroleum products.)	All nonporous surfaces.	Immerse or wash with solvent, then wash in hot soapy water and rinse with clear water.	Vapors are toxic. Fire precautions are required.
Brushing -------	Porous and nonporous surfaces.	Brush, sweep, dust from equipment or clothing.	Limited control of contaminated dust. Wear protective mask.

Hot spots may be reduced by sanding, filing, or grinding. These methods are not practicable for large areas—a protective mask and gloves must be worn.

Table X. Decontamination for Radiological Agents—Continued

Method	Contaminated object	Technique	Remarks
Launder	Clothing	Use hot soapy water and rinse with clear water.	Water requires disposal.
Bathing and scrubbing.	Personnel	Use brushes, running water, and soap.	Continue scrubbing until contamination level is safe.

CHAPTER 9
DESTRUCTION OF EQUIPMENT

66. General

a. Tactical situations may arise in which it is necessary to abandon equipment in a combat zone. In such a situation all equipment must be destroyed to prevent its use by the enemy.

b. Equipment will be destroyed only on the authority delegated by a division or higher commander.

67. Plans

A plan will be prepared by each battery to expedite destruction of equipment. The principles are as follows:

a. The plan must be adequate, uniform, easily executed.

b. Destroy essential parts first.

c. Destruction must be as complete as possible.

d. Destroy the *same* essential parts throughout the battery.

e. Destroy spare parts and accessories with the same priority as those installed on equipment.

68. Methods

a. The most generally applicable methods of destruction are—

(1) *Mechanical*—Requires ax, pick, sledge or similar equipment.

(2) *Burning*—Requires gasoline, oil, or other flammables.

(3) *Demolition* — Requires ammunition or explosives.

(4) *Gunfire* — Requires artillery, rocket launchers, rifle grenades, or hand grenades.

b. In general, destruction of essential parts, followed by burning is sufficient to render the weapon useless.

69. Reference

Detailed information on destruction of the equipment is contained in TM 9–325.

CHAPTER 10
SAFETY PRECAUTIONS

70. General

Safety precautions to be observed in training are prescribed in AR 385–63. Additional information is given in FM 6–40, FM 6–140, TM 9–325, and TM 9–1900. The more important safety precautions are summarized in this chapter.

71. Ammunition

The following precautions must be observed when handling ammunition:

a. Store ammunition in the firing area so that it is protected against accidental explosions.

b. Keep fire and flammables out of the area.

c. Protect ammunition from direct rays of the sun.

d. Do not disassemble fuzes.

e. All ammunition prepared for firing and not fired must be checked to insure that—

(1) Powder increments are present and in proper order and in good condition, and of the proper lot number.

(2) Lot number of the ammunition corresponds to the lot number on the container.

(3) Time fuzes are reset to SAFE and the safety wires are replaced.

72. Failure To Fire

If the weapon fails to fire—

a. Keep the weapon trained on the target.

b. Clear unnecessary personnel from the vicinity of the howitzer.

c. Make two additional attempts to fire the weapon.

d. Wait 2 minutes after the last attempt to fire.

e. The executive commands UNLOAD.

f. The assistant gunner opens the breech and number 1 removes the cartridge case.

g. If the primer is dented, a faulty primer is indicated, and the cartridge case is replaced.

h. If the primer is not dented, a faulty firing mechanism is indicated.

i. For detailed procedures refer to TM 9–325.

73. Drill and Firing

a. Load the weapon only when firing is imminent.

b. Personnel move in rear of the piece when going from side to side.

c. Personnel stay clear of recoil path.

d. Crew members should use earplugs or cotton to protect ear drums.

e. A safety officer will be present during all firing in training exercises. Specific duties for the safety officer are listed in FM 6–40.

CHAPTER 11
TRAINING

Section I. GENERAL

74. Purpose

The purpose of this chapter is to present the minimum requirements for training the howitzer section. It includes—

a. Information for conduct of training.

b. Minimum training schedule.

c. Gunner's qualification tests.

75. Conduct of Training

Section training is *conducted* by the section chief. Battery officers are responsible for preparing the training plans and for supervising their execution. The chief of section—

a. Trains *each* member of his section to function smoothly and efficiently in *all duties* in the section.

b. Welds the section into an effective, coordinated team, capable of functioning efficiently in combat.

c. Emphasizes the application of prior instruction to current training.

d. Maintains a progress card on each man to show—

(1) Instruction attended.

(2) Tests taken.
(3) Remarks pertaining to progress.

e. References: AR 611–201, ATP 6–100, FM 21–5, and FM 6–125.

Section II. MINIMUM TRAINING SCHEDULE

76. Training Periods

a. The principles that should be followed in scheduling and preparing training periods are listed below:

(1) Arrange periods in service of the piece drill along with other battery training to provide a balanced training program.
(2) Section drill should not exceed 30 minutes and be conducted in a vigorous manner.
(3) Precede and follow howitzer drill with logically related subjects. For example, precede the drill period with tests and adjustments and follow with inspection and maintenance.

b. Army Subject Schedule 6–3 provides uniform guidance for cannoneer training.

c. Operational and maintenance characteristics of the weapon are referenced in TM 9–325.

d. The training schedule outlined in paragraph 77 is a guide to meet minimum training requirements.

77. Schedule

Method*	Hours	Subject	Text reference	Training aids and equipment
C, D, PW.	1	Organization and composition of gun section; general duties of individuals; formation of gun section.	Par. 2, 3, 10, tables, I, II, III, and IV.	Gun and prime mover.
C, D, PW.	1	Posts and posting of cannoneers; changing posts; mounting and dismounting.	Par. 12-15---	Do.
C, D, PW.	2 (1 hour periods).	Coupling and uncoupling; prepare for action, and march order; movement of gun by hand.	Tables I and IV.	Do.
C, D, PW.	24 (½ hour periods).	Gun drill, duties in firing, indirect laying.	Par. 20 and table II.	TOE equipment.
C, D, PW.	9 (½ hour periods).	Gun drill duties in firing, direct laying.	Par. 21, 22, and table III.	Do.
C, D, PW.	6 (1 hour and ½ hour periods).	Testing and adjustment of sighting and fire control equipment.	Par. 33-55---	Do.

See footnote on page 79.

Method*	Hours	Subject	Text reference	Training aids and equipment
C, D, PW.	2 (½ hour periods).	Aiming post displacement correction----	Par. 29-----	TOE equipment, blackboard, and chalk.
C, D, PW.	4 (½ hour periods).	Inspections and maintenance drills------	Par. 56-61---	TOE equipment.
C, D, PW.	1	Decontamination of materiel----------	Par. 62-65---	Decontamination equipment; TOE equipment.
C, D, PW.	1	Destruction of materiel to prevent use by the enemy.	Par. 66-69---	Demolition and TOE equipment.
C, D---	1	Safety precautions----------	Par. 70-73---	TOE equipment.
PW----	16 (4 hour periods)	Service, practice, indirect laying--------	Par. 17-20, table II.	TOE equipment.
PW----	4	Service, practice, direct laying----------	Par. 21-24, table III.	Do.

C, PW	6 (1 hour periods).	Review and tests of subjects previously covered.	All previous references.	Do.

* C—Conference; D—Demonstration; PW—Practical Work (78 hr.).

Section III. GUNNER'S QUALIFICATION TESTS

78. Purpose and Scope

This section prescribes the tests to be given in the qualification of gunners. The purpose of the test is twofold—

a. To provide a means of determining the relative proficiency of the individual artillery soldier in the performance of the duties of the gunner, 105-mm howitzer M101 and modifications. *The tests will not be a basis for determining the relative proficiency of batteries or higher units.*

b. To serve as an adjunct to training.

79. General Instructions

a. Standards of Precision. The candidate will be required to perform the tests in accordance with the standards listed below:

(1) Scale settings must be exact and matching indexes must be brought into coincidence.

(2) Level bubbles must be exactly centered.

(3) The vertical reticle of the panoramic telescope must be alined on the left edge of the aiming post or on exactly the same part of the aiming point each time the piece is laid.

(4) Final motions of azimuth and elevation setting knobs, as well as traversing and elevating handwheels, must be made in the appropriate direction. For elevating, the final motion of the handwheel should be in the direction of the more

difficult movement. Final motion for traversing is from left to right. Final movement of the vertical reticle of the telescope is from left to right.

b. Assistance. The candidate will receive no unauthorized assistance. Each candidate may select authorized assistants as indicated in the tests. In the event a candidate fails any test because of the fault of any assistant, the test will be disregarded, and the candidate will be given another test of the same nature.

c. Time. The time for any test will be the time from the last word of the command to the last word of the candidate's report. The candidate may begin any test after the first word of the first command.

d. Scoring. Scoring will be conducted in accordance with the subparagraphs *Penalties* and *Credit* under each subject. If a test is performed correctly, credit will be given in accordance with the subparagraph *Credit* under each subject. No credit will be allowed if conditions exist as specified in the subparagraphs headed *Penalties.*

e. Preparation for Tests. The howitzer will be prepared for action and the candidate posted at the proper position corresponding to the test being conducted or as indicated in the subparagraphs entitled "Special instructions." The examiner will insure that the candidate understands the requirements of each test and will require the candidate to report "I am ready" before each test.

f. Qualification Scores. Minimum scores required for qualification in the courses are as follows:

Individual classification	*Points*
Expert gunner	90
First-class gunner	80
Second-class gunner	70

80. Outline of Tests

Paragraph	Subject	Number of tests	Points each	Maximum credit
81	Direct laying, panoramic telescope	4	2	8
82	Direct laying, elbow telescope	4	2	8
83	Indirect laying, deflection only	18	2	36
84	Laying for quadrant with range quadrant	3	2	6
85	Laying for quadrant with gunner's quadrant	3	2	6
86	Displacement correction	2	---	4
	Part I	(1)	3	(3)
	Part II	(1)	1	(1)
87	Measuring site to the mask	1	4	4
88	Measuring quadrant	1	4	4
89	Measuring deflection	1	4	4
90	Tests and adjustment of sighting and fire control equipment	6	---	10
	Tests 1, 3, 4, and 5	(4)	2	(8)
	Tests 2 and 6	(2)	1	(2)
91	Materiel	3	---	10
	Tests 1 and 2	(2)	3	(6)
	Test 3	(1)	4	(4)
Total credit				100

81. Direct Laying, Panoramic Telescope

a. Scope of Tests.

(1) Four tests (two groups of two tests

each) will be conducted in which the candidate will be required to execute commands similar to those given in *c* below.

(2) Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.

(3) The candidate will be tested in the duties of the gunner, using the one-man, one-sight system.

b. Special Instructions.

(1) A stationary target will be placed approximately 600 meters from the howitzer.

(2) The fixed azimuth scale and micrometer scale will be set at zero, and indexes on telescope mount will be matched.

(3) The candidate will be posted as the gunner.

(4) The weapon will be pointed so that—

(*a*) A shift of approximately 100 mils will be required for tests 1 and 3.

(*b*) It will not be necessary to shift the trails for any of the four tests.

(5) Laying at the termination of tests 1 and 3 will not be disturbed prior to beginning tests 2 and 4.

(6) The examiner will announce the assumed direction of the movement of the target at the beginning of tests 1 and 3. The assumed direction of the movement of the target in test 3 will be opposite to that in test 1.

c. Outline of Tests.

Test No.	Examiner commands (for example)	Action of candidate
1 and 3.	TARGET, THAT TANK; LEAD 5, RANGE 5, RANGE 600.	Traverses piece until proper lead has been set. Places proper range line of reticle on the center of the visible mass of the target. Centers cross-level bubble. Gives the command FIRE when ready and steps clear.
2 and 4.	RIGHT (LEFT) 10, ADD (DROP) 200.	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test—

(1) The azimuth scale has been moved from zero.

(2) The indexes on the azimuth micrometer have been moved from zero.

(3) The indexes on the telescope mount are not in coincidence.

(4) The lead in mils is not set properly.

(5) The proper range line of the reticle is not on the center of the visible mass of the target.

e. Credit.

Time in seconds, exactly or less than	4	4⅘	5
Credit	2.0	1.5	1.0

82. Direct Laying, Elbow Telescope

a. Scope of Tests.

(1) Four tests (two groups of two tests

each) will be conducted in which the candidate will be required to execute commands similar to those given in *c* below.

(2) Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.

(3) The candidate will be tested in the duties of the assistant gunner, using the two-man, two-sight system.

b. Special Instructions.

(1) A stationary target will be placed approximately 600 meters from the piece.

(2) For tests 1 and 3, the field of view of the telescope will be placed on the target, with the correct range line more than 100 meters off the target.

(3) The laying of the piece will not be disturbed after tests 1 and 3.

c. Outline of Tests.

Test No.	Examiner commands (for example)	Action of candidate
1 and 3.	TARGET, THAT TANK: RANGE 500.	Places proper reticle line for announced range on the center of the visible mass of the target. Calls "Set" and steps clear.
2 and 4.	ADD (DROP) 400_____	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test—

(1) The correct range line is not on the center of the visible mass of the target.

(2) The range lines of the reticle are not approximately horizontal.

e. Credit.

Time in seconds, exactly or less than	1½	1⅘	2
Credit	2.0	1.5	1.0

83. Indirect Laying, Deflection Only

a. Scope of Tests. Eighteen tests will be conducted in which the candidate will be required to execute commands similar to those given in *c* below. Tests 1 through 4 (and tests 5–9, 10–13, and 14–18) will be executed as one series of commands.

b. Special Instructions.

(1) Commands will not necessitate shifting trails.

(2) The examiner will select a suitable aiming point and identify it to the candidate.

(3) Commands for special corrections will be given *only* in the tests indicated in the examples in *c* below.

(4) The command for new deflections for each test will be within the following prescribed limits.

Test No.	Maximum change (mils)	Minimum change (mils)
2 and 11	180	140
3 and 12	90	70
4 and 13	40	20
7 and 16	100	60
8 and 17	50	30
9 and 18	20	10

(5) The piece will be laid with correct settings at the conclusion of each test before proceeding with the next test.

(6) Aiming posts will be set out at prescribed deflection and distances for these tests.

(7) Special corrections for deflection may be omitted from the test if the unit SOP requires that deflection corrections be applied at the fire direction center.

(8) The examiner will designate the section number of the weapon to be used. The examiner will announce special corrections in deflection to be applied by the candidate.

c. Outline of Tests.

Test No.	Examiner commands (for example)	Action of candidate
1 and 10.	SPECIAL CORRECTIONS, DEFLECTION 2890, NUMBER 1 LEFT 7.	Sets deflection and applies special correction. Centers cross- and longitudinal - level bubbles. Traverses piece until vertical hair is on left edge of aiming posts. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
2 and 11.	DEFLECTION 2760_____	Sets deflection change. Leaves correction on gunner's aid.

Test No.	Examiner commands (for example)	Action of candidate
		Lays on aiming posts. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
3 and 12.	DEFLECTION 2835_____	Same as test 2 above.
4 and 13.	NUMBER 1, RIGHT 4___	Same as test 2 above, but changes gunner's aid to right 4 and resets deflection 2835 opposite index.
	At conclusion of test 4 (13) give END OF MISSION. (No time considered for this operation.)	Gunner moves gunner's aid to zero.
5 and 14.	AIMING POINT, CHURCH STEEPLE, REFER.	Refers telescope to church steeple. Reads deflection and calls "Number 1, deflection (so much)."
6 and 15.	DEFLECTION 2800, REFER.	Slips the slipping azimuth micrometer scale to 2800. Verifies that vertical reticle is on church steeple. Calls "Number 1, deflection 2800." Steps clear.
7 and 16.	SPECIAL CORRECTIONS DEFLECTION 2920 NUMBER 1 LEFT 7.	Same as test 1 above.

Test No.	Examiner commands (for example)	Action of candidate
8 and 17.	DEFLECTION 3040------	Same as test 2 above.
9 and 18.	DEFLECTION 3080------	Same as test 2 above.

d. Penalties.

(1) No credit will be allowed if, after each test—

(*a*) The deflection is set incorrectly.

(*b*) The cross-level or longitudinal-level bubble is not centered.

(*c*) The vertical hair of the telescope is not on the aiming point or left edge of aiming posts, as the case may be.

(2) No credit will be allowed if the last motion of the traverse was not made to the right.

e. Credit. Time in seconds, exactly or less than—

Tests 1, 10, 6, and 15 each----------	12	13	14
Other tests, each----------	8	9	10
Credit ----------	2.0	1.5	1.0

84. Laying for Quadrant With Range Quadrant

a. Scope of Tests. Three tests will be conducted in which the candidate will be required to execute commands similar to those given in *c* below.

b. Special Instruction.

(1) Each test will require a change of settings and the accompanying laying of

the tube in elevation within the following limits: Quadrant elevation, 35 to 65 mils.

(2) Command for quadrant for tests 2 and 3 will not be made in multiples of 5 mils.

(3) Special corrections will be applied by the candidate if required by unit SOP. Otherwise they may be omitted.

(4) The candidate will be posted as number 1 cannoneer.

c. Outline of Tests.

Test No.	Examiner commands (for example)	Action of candidate
1	QUADRANT 275----------	Sets site 300 and announced quadrant elevation. Centers cross-level and longitudinal-level bubbles. Calls "Set" and steps clear.
2	QUADRANT 313----------	Same as test 1 above.
3	SPECIAL CORRECTIONS, NUMBER 1 UP 2, QUADRANT 333.	Same as test 1 above.

d. Penalties.

(1) No credit will be allowed if, after each test—

(*a*) The quadrant is not set accurately.

(*b*) The cross-level or longitudinal-level bubble is not centered.

(2) No credit will be allowed if the last movement of the tube was not in the

direction in which it is most difficult to turn the elevating handwheel.

e. Credit.

Time in seconds, exactly or less than	6⅗	7⅗	8⅗
Credit	2.0	1.5	1.0

85. Laying for Quadrant With Gunner's Quadrant

a. Scope of Tests. Three tests will be conducted in which the candidate will be required to execute commands similar to those given below.

b. Special Instructions.

(1) The gunner's quadrant will be set at zero for the first test.

(2) Each succeeding test will require a change of quadrant elevation setting within the limits of 30 to 60 mils.

(3) The candidate will be posted to the left of and facing the breech, with the gunner's quadrant in his hand.

(4) An assistant, selected by the candidate, will be posted to the right of the breech to operate the elevating handwheel.

c. Outline of Tests.

Test No.	Examiner commands (for example)	Action of candidate
1	QUADRANT 180----------	Sets quadrant elevation on gunner's quadrant. Seats quadrant. Has assistant elevate or depress the tube until the quadrant bubble is centered.

Test No.	Examiner commands (for example)	Action of candidate
		Calls "Ready" and waits for examiner to verify laying.
2	QUADRANT 240----------	Same as test 1 above.
3	QUADRANT 205----------	Same as test 1 above.

d. Penalties.

(1) No credit will be allowed if, after each test—

(*a*) The quadrant elevation is set incorrectly.

(*b*) The quadrant is not properly seated.

(*c*) The quadrant bubble is not properly centered.

(2) No credit will be allowed if the last movement of the tube was not in the direction in which it is most difficult to turn the elevating handwheel.

e. Credit.

Time in seconds, exactly or less than------	6	6⅗	7
Credit ----------	2.0	1.5	1.0

86. Displacement Correction

a. Scope of Test. One test, consisting of two parts, will be conducted in which the candidate will be required to execute the commands given in *c* below.

b. Special Instructions.

(1) Aiming posts will be set out at the prescribed distances.

(2) An assistant, selected by the candidate, will be stationed close to the far aiming post.

(3) The examiner will require the candidate to lay the piece on an announced deflection and report "I am ready."

(4) The far post or the weapon will then be moved so that a displacement of 5 to 10 mils occurs.

(5) The laying of the weapon at the termination of part I will not be disturbed for part II.

c. Outline of Test.

(1) *Part I.*

Examiner commands	Action of candidate
CORRECT FOR DISPLACEMENT.	Lays the piece so that the far post appears midway between the near post and the vertical reticle of the telescope. Checks centering of bubble. Re-lays if necessary. Calls "Ready" and steps clear.

(2) *Part II.*

Examiner commands	Action of candidate
ALINE AIMING POST----	Records deflection on shield and announces "Deflection (so much) recorded." Directs assistant in alining aiming posts. Calls "Ready" and steps clear.

d. Penalties. No credit will be allowed if—

(1) *Part I.*

(*a*) The far aiming post does not appear

midway between the near post and the vertical reticle of the telescope.

(*b*) The cross-level or longitudinal-level bubble is not centered.

(*c*) The last motion of traverse was not made to the right.

(2) *Part II.*

(*a*) The deflection is other than the announced deflection.

(*b*) The aiming posts are not properly alined.

(*c*) The vertical reticle of the telescope is not on the aiming posts.

e. Credit.

Part I, time in seconds exactly or less than	3	3⅓	3⅔	4
Credit	3.0	2.0	1.5	1.0
Part II, no time limit.				
Credit	1.0	--	--	--

87. Measuring Site to Mask

a. Scope of Test. One test will be conducted in which the candidate will be required to execute the command given in *c* below.

b. Special Instructions.

(1) The piece prepared for action will be placed 200 to 400 meters from a mask of reasonable height.

(2) The tube will be pointed so that it is 100 to 150 mils above the crest and 100 to 150 mils right or left of the highest point of the crest.

(3) The candidate will take post at the right rear of the breech.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE SITE TO MASK.	Sights along lowest element of bore and operates elevating and traversing mechanism until line of sight just clears crest. Sets angle of site scale at 300, centers longitudinal-level bubble by turning elevating knob, and centers cross-level bubble. Reads elevation from elevation scale and micrometer. Reports "Number (so-and-so), site to mask (so much)."

d. Penalties. No credit will be allowed if—

(1) The line of sight along the lowest element of the bore does not just clear credit.

(2) The cross-level or longitudinal-level bubble is not properly centered.

(3) The angle of site scale does not read 300.

(4) The site is announced incorrectly.

(5) The last movement of the tube was not in the direction in which it is most difficult to turn the elevation handwheel.

e. Credit.

Time in seconds, exactly or less than	11	12	13	14
Credit	4.0	3.0	2.0	1.5

88. Measuring Quadrant

a. Scope of Test. One test will be conducted in which the candidate will be required to measure the quadrant by means of the gunner's quadrant.

b. Special Instructions. Prior to the test the examiner will lay the tube at a selected quadrant, measure the quadrant, and then set the gunner's quadrant at zero.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE THE QUADRANT.	Places gunner's quadrant on quadrant seats of the breech rings. Levels bubble by raising or lowering the index arm and turning the micrometer knob. Announces "Number ( ) Quadrant ( )," hands quadrant to examiner.

d. Penalties. No credit will be allowed if—

(1) The quadrant bubble is not centered when the quadrant is seated properly.

(2) The quadrant is announced incorrectly.

e. Credit.

Time in seconds, exactly or less than	8	9⅖	10⅖
Credit	4.0	3.0	2.0

89. Measuring Deflection

a. Scope of Test. One test will be conducted in which the candidate will be required to measure

and report a deflection in accordance with the command given below.

b. Special Instructions.

(1) The piece will be laid on aiming posts to the left front.

(2) An aiming point within 200 mils to the left or right of the aiming posts will be designated by the examiner and identified by the candidate.

c. Outline of Test.

Examiner commands	Action of candidate
NUMBER ( ), AIMING POINT, THAT ( ), REFER.	Centers cross-level and longitudinal-level bubble. Refers to aiming point. Checks centering of bubbles and re-lays telescope if necessary. Reads deflection and reports, "Number ( ), deflection ( )" and steps clear.

d. Penalties. No credit will be allowed if—

(1) The cross-level or longitudinal-level bubble is not centered properly.

(2) The vertical reticle of the telescope is not on the aiming point.

(3) The deflection is announced incorrectly.

(4) The traversing handwheel is turned.

e. Credit.

Time in seconds, exactly or less than	4.0	3.0	2.0	1.5
Credit	5	5⅔	6	6⅔

90. Test and Adjustment of Sighting and Fire Control Equipment

a. Scope of Tests. Six tests will be conducted in which the candidate will be required to demonstrate the methods employed in making the prescribed tests and authorized adjustments, or describe the action taken (e.g., send to the ordnance maintenance company) if adjustment is not authorized to be made by using personnel.

b. Special Instructions.

(1) The piece will be prepared for the tests as indicated in paragraph 47 of this manual.

(2) The equipment which will be needed for the tests is listed in paragraph 35 of this manual.

(3) The candidate will select an assistant to operate the elevating handwheel at the direction of the candidate during tests 1 and 2 and adjust and aline the testing target at the direction of the candidate prior to test 5.

(4) The tests will be conducted in the chronological sequence indicated in *c* below. After completion of test 2, the gunner's quadrant used in tests 1 and 2 will be used for test 3, with the proper correction as determined in test 1 carried on the quadrant, provided the correction does not exceed 0.4 mil.

(5) Adjustments which the candidate may be required to accomplish will fall within the following limits:

(*a*) Elevation and angle of site scales, not to exceed one 100-mil graduation.

(*b*) Elevation and angle of site micrometer scales, not to exceed ten 1-mil graduations.

(*c*) Rotating head and telescope mount elevation indexes, none.

(*d*) Rotating head and telescope mount elevation micrometer indexes, not to exceed one-fourth turn.

(*e*) Panoramic telescope azimuth scale, not to exceed one 100-mil graduation.

(*f*) Panoramic telescope slipping azimuth micrometer scale, not to exceed ten 1-mil graduations.

(6) The tube will be leveled at the conclusion of test 2 and will not be disturbed thereafter.

Test No.	Examiner commands	Action of candidate
1	PERFORM END-FOR-END TEST ON GUNNER'S QUADRANT.	Performs test as prescribed in paragraph 49 of this manual. Calls "Error (so many) mils, quadrant serviceable (unserviceable)" and hands quadrant to examiner for verification.
2	PERFORM MICROMETER TEST ON GUNNER'S QUADRANT.	Performs test as prescribed in paragraph 50 of this manual.

Test No.	Examiner commands	Action of candidate
		Calls "Quadrant micrometer is (is not) in error."
3	TEST TELESCOPE MOUNT.	Performs tests and makes adjustments, if necessary, as prescribed in paragraphs 38 and 53 of this manual.
		Calls "Cross- (longitudinal-) level bubble(s) within (without) allowable limit.
	Caution: **Do not turn cross-leveling or elevation knobs of the telescope mount after this test**	
4	TEST RANGE QUADRANT	Performs tests and makes adjustments, if necessary, as prescribed in paragraphs 38 and 52 of this manual.
		Calls "Ready" and steps clear.
	Note. Prior to test 5, the cross- and longitudinal-leveling of the tube and the panoramic telescope mount will be verified by the examiner, and the testing target will be alined by the candidate with the help of his selected assistant as described in paragraph 54 of this manual.	
5	TEST ADJUSTMENT OF PANORAMIC TELESCOPE.	Performs tests and makes adjustments, as prescribed in

Test No.	Examiner commands	Action of candidate
		paragraph 38 of this manual. Calls "Ready" and steps clear.
6	TEST ADJUSTMENT OF ELBOW TELESCOPE.	Performs tests and makes adjustments, as prescribed in paragraph 38 of this manual. Calls "Ready" and steps clear.

c. Penalties.

(1) *General.* The tests are not essentially speed tests. The purpose of the prescribed time limits is to insure that the candidate can perform the operation without wasted effort.

(2) *Test 1.* No credit will be allowed if—

(*a*) The bubble of the gunner's quadrant does not center when verified by the examiner.

(*b*) The error (one-half of the amount of the angle which was indicated when the quadrant was first reversed and the bubble centered by moving the index arm and micrometer) is announced incorrectly by the candidate.

(*c*) The candidate fails to declare the quadrant unserviceable if the error (necessary correction) exceeds 0.4 mil, or fails to declare the quadrant

serviceable if the error (necessary correction) is 0.4 mil or less.

(*d*) The time to complete the test exceeds 2 minutes.

(3) *Test 2.* No credit will be allowed if—

(*a*) The procedure is not followed correctly.

(*b*) The time to complete the test exceeds 1 minute.

(4) *Test 3.* No credit will be allowed if—

(*a*) The bubble of the gunner's quadrant is not centered in either direction.

(*b*) The candidate does not announce correctly the status of either the cross-level or the longitudinal-level bubble.

(*c*) The matching indexes on the rocker and actuating arm or those on the elevation knob and shaft are not in coincidence when the adjustments are complete.

(*d*) The time to complete the test and adjustments exceeds 4 minutes.

(5) *Test 4.* No credit will be allowed if—

(*a*) The elevation micrometer does not read zero when the elevation scale reads zero.

(*b*) The angle of site does not read 300 when the cross-level and longitudinal-level bubbles are centered.

(*c*) The cross-level or longitudinal-level bubble is not properly centered.

(*d*) The time to complete the tests and adjustments exceeds 2 minutes.

(6) *Test 5.* No credit will be allowed if—

(*a*) The candidate fails to make adjustments when such adjustments are indicated.

(*b*) The rotating head elevation micrometer indexes are not in coincidence.

(*c*) The zero line of either the azimuth scale or azimuth scale micrometer is not in coincidence with its respective index.

(*d*) The centerline of the bore, as viewed through the boresights, or the line of sight of the telescope does not fall on the respective sighting points on the testing target when all scales are set at zero.

(*e*) The time to complete the tests and adjustments exceeds 4 minutes and 30 seconds.

(7) *Test 6.* No credit will be allowed if—

(*a*) The reticle is not horizontal.

(*b*) The "N" range line is not in coincidence with the proper sighting line of the testing target.

(*c*) The time to complete the test and adjustment exceeds 1 minute.

d. Credit.

(1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.

(2) If the tests and adjustments are performed correctly within the prescribed

time limits, maximum credit will be given as follows:

Test 1	2
Test 2	1
Test 3	2
Test 4	2
Test 5	2
Test 6	1
Total	10

91. Materiel

a. Scope of Tests. The candidate will be required to perform three tests as outlined below.

b. Special Instructions.

(1) *Tests 1 and 2.* For tests 1 and 2, a paulin will be placed on the ground for the convenience of the candidate in laying out the disassembled parts. The candidate will be allowed to select the tools and accessories necessary for the performance of the tests prior to the start of the tests.

(2) *Test 3.*

(*a*) A complete set of lubrication equipment authorized for use of battery personnel will be made conveniently available on a paulin adjacent to the howitzer.

(*b*) Every type of lubricant used on the weapon will be placed conveniently on the paulin, in plainly labeled containers.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	DISASSEMBLE BREECH MECHANISM AND FIRING LOCK.	Performs the operation as prescribed in TM 9–325, laying the parts on the paulin. After disassembly, identifies all parts to examiner.
2	ASSEMBLE BREECH MECHANISM AND FIRING LOCK.	Performs the operation as prescribed in TM 9–325.
3	LUBRICATION TEST_____	Selects proper lubricating equipment and lubricant and shows *how* and with *which lubricant* each lubrication point is serviced. (Actual lubrication is not performed.)

d. Penalties.

(1) The tests are not essentially speed tests. The purpose of the maximum time limits is to insure that the candidate can perform the operations without wasted effort.

(2) No credit will be given if the following time limits are exceeded:

Test 1_____ 1½ minutes
Test 2_____ 3 minutes
Test 3_____ 2 minutes

(3) A penalty of one-half point will be assessed for each component part not correctly identified or omitted in test 1.

There is no time limit imposed on the identification of component parts. However, the examiner may reduce the grade if it becomes obvious that the candidate is not familiar with the nomenclature.

e. Credit.

(1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.

(2) If each test is performed correctly within the prescribed time limit, maximum credit will be given as follows:

Test 1	3
Test 2	3
Test 3	4
Total	10

APPENDIX

REFERENCES

AR 320–5	Dictionary of United States Army Terms.
AR 320–50	Authorized Abbreviations and Brevity Codes.
AR 385–63	Regulations for Firing Ammunition for Training Target Practice and Combat.
AR 611–201	Manual of Enlisted Military Occupational Specialties.
AR 672–5–1	Awards.
AR 750–5	Organization Policies and Responsibilities for Maintenance Operation.
DA Pam 108–1	Index of Army Motion Pictures, Film Strips, Slides and Phono-Recordings.
DA Pam 310-series	Index of Military Publications.
FM 5–15	Field Fortifications.
FM 5–20	Camouflage, Basic Principles and Field Camouflage.
FM 5–25	Explosives and Demolitions.
FM 6–20–2	Field Artillery Techniques.
FM 6–40	Field Artillery Cannon Gunnery.
FM 6–125	Qualification Tests for Specialist Field Artillery.
FM 6–140	The Field Artillery Battery.
FM 17–50	Armor Logistics
FM 21–5	Military Training.
FM 21–30	Military Symbols.
FM 21–40	Small Unit Procedures in Nuclear, Biological, and Chemical Warfare.

FM 21–60	Visual Signals.
FM 22–5	Drills and Ceremonies.
FM 31–70	Basic Cold Weather Manual.
ATP 6–100	Army Training Program for Field Artillery Units.
ATT 6–117	Training Test for Field Artillery Howitzer Battery, Light or Medium, Towed and Self-Propelled.
FT 105–H–6	Firing Tables for Howitzer, 105-mm.
TM 3–220	Chemical, Biological, and Radiological Decontamination.
TM 9–238	Deep Water Fording of Ordnance Materiel.
TM 9–325	105-mm Howitzer M2A1, Carriages M2A1 and M2A2, and Combat Vehicle Mounts M4 and M4A1.
TM 9–500	Ordnance Corps Equipment Data Sheets.
TM 9–575	Auxiliary Sighting and Fire Control Equipment.
TM 9–1527	Ordnance Maintenance: Gunner's Quadrants M1 and M1918 and Machine Gun Clinometer M1917.
TM 9–1590	Ordnance Maintenance: Fuze Setters, M14, M22, M23, M25, and M27.
TM 9–1900	Ammunition, General.
TM 9–6111	Panoramic Telescope, M1, M12, M12A2, M12A5 and M12A6.
TM 21–301	Driver Selection, Training and Supervision; Tracked Vehicles.
TM 38–750	The Army Equipment Records System and Procedures.
SM 9–5–1315	Ammunition, 75-mm Through 125-mm.
SM 9–5–1390	Ammunition and Explosives, Fuzes and Primers.

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By Order of the Secretary of the Army:

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Chief of Staff.

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6–117 (5)
6–155 (5)
6–157 (5)
6–215 (5)
6–217 (5)
6–405 (5)
6–407 (5)
6–407 (5)
17–22 (1)

NG: State AG (3); TOE: 1–7 (1); 6–100 (3); 6–115 (3); 6–116, 6–117, 6–126, 6–127, 6–401, 6–501 (1); 17–1 (1).

USAR: Same as Active Army except allowance is one copy to each unit.

For explanation of abbreviations used, see AR 320–50.

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Table V. Trajectory Characteristics, Shell HE, Charge 7; Shell HEP–T

Shell HEP–T				Shell HE, charge 7	
Range (meters)	Elevation	Trajectory characteristics	Firing data	Range (meters)	Elevation
100	2	Within these ranges, the trajectory is flat enough to prevent an 8-foot tank from passing under it. A range of 400 meters is ideal for opening fire, because fires can be conducted for the maximum time without misses if deflection is correct.	Start firing using 400 meter range setting.	100	2
200	3			200	5
300	5			300	7
400	7			400	10
500	9			500	12
600	11				
700	13	Within these ranges, the trajectory is sufficiently flat to permit direct estimate of range without bracketing the target. If a hit is obtained at the bottom of an 8-foot tank, the addition of a 100-meter range change will result in a round that will just brush the top of the tank. Range changes will seldom be more than 100-meters, and 50-meter range changes will frequently be sufficient. These are the maximum ranges at which a tank should be fired on, unless tactical conditions require otherwise.	1. Start firing with the estimated range at the closest 100-meter range. 2. Make range changes with 50- or 100-meter increments. 3. Bracket adjustment of the target (overs and shorts) is not required.	600	15
800	15			700	17
900	18			800	20
1000	20			900	23
1100	22				
1200	25	Within these ranges, hits are only reasonably possible. Bracket adjustment of the target is normally required.	1. Start firing with the estimated range at the closest 100-meter range. 2. Adjustment on the target by bracketing (overs and shorts) is required. 3. Surprise effect on the target must not be important.	1000	25
1300	28			1100	28
1400	31			1200	31
1500	34			1300	34
1600	37			1400	37
1700	40			1500	40
1800	44			1600	43
				1700	46
				1800	49
Over 1800		Direct laying at moving targets is not advisable. At these ranges the slope of fall of the projectile is such that a hit on a moving target is very difficult to obtain.		Over 1800	

Table VI. Before-operation Service

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	Driver
1	Supervises inspections by members of the gun section in all sequences.	Inspects condition, completeness, contents, and security of section chest.						Assists the prime mover driver in inspection and maintenance of his vehicle when directed to do so by the chief of section. Loads ammunition in prime mover and trailer as directed.	Performs "before operation" duties as prescribed in appropriate technical manual for his prime mover, assisted by cannoneer number 5 when so directed by chief of section.
2	Verifies that howitzer is properly coupled.	Releases left wheel handbrake.	Releases right wheel handbrake before coupling.	Inspects condition and security of rammer staff.					
3	Verifies that handbrakes are released.			Disconnects and removes light system from howitzer.	Inspects overall cover for torn or worn places and for broken or missing fastenings.				
4	Inspects recoil system for signs of oil leakage.	Removes breech end of overall cover.		Inspects condition and security of trail handspike.		Remove muzzle end of overall cover.	Removes muzzle cover.		
5	Supervises the gunner in making tests and adjustments of sighting and fire control equipment.	Inspects condition and security of sighting and fire control equipment, except elbow telescope.	Inspects elbow telescope for condition and security. Inspects breechblock, firing mechanism, chamber, and bore for cleanliness, freedom from foreign matter, and lubrication.	Inspects tires for wear, bruises, cuts, stones in treads, and for low air pressure. Inspects wheels for loose or missing nuts, hubcap screws, and valve caps.	Inspects drawbar to see that it is in proper position and securely locked.	Inspects left axle lock for proper fastening in traveling position.	Inspects right axle lock for proper fastening in traveling position.		
6	Inspects oil index to insure that proper reserve of oil is present in the recoil system (TM 9-325).					Inspects cradle lock strut for adjustment and fastening.	Inspects condition and security of aiming posts on trails.		
7	Inspects ammunition for lot number, condition, and stowage.			Determines presence of ample supply of cleaning and preserving material.	Inspects carriage for loose parts, condition of tube fittings, and for cracked or broken welds.	Assures that left latch is holding bottom shield flap in traveling position.	Assures that right latch is holding bottom shield flap in traveling position.		
8	Verifies presence of proper supply of gasoline, oil, water, and emergency rations.					Inspects cradle traveling locks for adjustment.	Inspects barrel locking ring and locking nuts for security.		
9	Inspects loading of section equipment for completeness and security.	Inspects position and fastening of shield.			Inspects for grease and oil leakage on or under carriage.	Cleans and oils elevating rack and pinions.	Cleans and greases recoil slides.		
10	Verifies presence of technical manuals and lubrication orders for prime mover and howitzer, equipment log book, accident report form, and vehicle identification card.	Replace breech end of overall cover.				Replaces muzzle end of overall cover.	Replaces muzzle cover.		
11			Inspects condition and fastening of trail traveling lock and latch.	Replaces and connects light system on howitzer.	Loads ammunition in prime mover and trailer.	Load ammunition in prime mover and trailer.			
12	Receives reports of personnel of his section upon completion of their duties in inspection.	Reports, "Gunner ready."	Reports, "Assistant gunner ready."	Reports, "Number 1 ready."	Reports, "Number 2 ready."	Reports, "Number 3 ready."	Reports, "Number 4 ready."	Reports, "Number 5 ready."	Reports, "Driver ready."
13	Reports to battery executive when section personnel have completed their duties, "Sir, number ( ) in order," or reports any defects which the section cannot remedy without delay or assistance.								

Table VII. During-operation Service.

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	Nos. 2–5 inclusive	Driver
1	Supervises inspection and maintenance at halt. Insures that personnel remain to right of left wheel line except to inspect left wheels.	Inspects for presence, condition, and security of sighting equipment, covers, staff sections, aiming posts, trail handspikes, and section chest.	Inspects coupling of howitzer to prime mover.	Inspects tires and wheels. (Inspects tires for wear, bruises, cuts, stones in treads, and for correct air pressure.) Inspects wheels for loose or missing nuts, hubcap screws, valve caps, and overheated wheel bearings.	Perform duties as prescribed by chief of section.	Performs service as prescribed for his vehicle.
2			Inspects trail traveling lock and latch for condition and fastening.			
3			Inspects connection, functioning, and mounting of light system and inspects fastening of overall cover.			
4	Receives reports of personnel upon completion of their duties.	Reports, "Gunner ready."	Reports, "Assistant gunner ready."	Reports, "Number 1 ready."	Reports, "Number ( ) ready."	Reports, "Driver ready."
5	Reports to battery executive when inspection is completed, "Sir, number ( ) in order," or reports any defects that the section cannot remedy without delay.					

Table VIII. After-operation Service.

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	Driver
1	Supervises detailed inspection and maintenance of howitzer in all sequences.	Inspects for presence of all sighting and fire control equipment, cleans, secures, and, to the extent that he is authorized, lubricates them.	Inspects, cleans, and secures elbow telescope.	Removes, cleans, and replaces rammer staff and trail handspike.				As directed by the chief of section. May assist prime mover driver in inspection and maintenance or perform other duties as directed by chief of section.	Performs after operation duties as prescribed for his vehicle, assisted by cannoneer number 5 when so directed by chief of section.
2	Inspects tools' accessories, and equipment for completeness and condition.			Inspects tires and wheels for damage and loose or missing parts; tests air pressure of tires and corrects if it is necessary.					
3	Inspects ammunition for lot number, complete rounds, and general condition.			Removes and cleans light system equipment and stores it in section chest.	Inspects fastenings and general condition of cover.				
4		Remove breech portion of overall howitzer cover.		Cleans and lubricates the bore.		Remove muzzle portion of overall howitzer cover.	Removes muzzle cover.		
5	Inspects recoil system for signs of leakage and supervises filling to correct oil reserve when necessary (TM 9-325).	Inspects shield fastenings.	Removes, cleans, oils, and replaces breech mechanism, assisted by section personnel as directed by chief of section.	Cleans howitzer and carriage.		Clean howitzer and carriage.			
6	Verifies the presence of and makes current entries in the equipment log books, and other required documents.	Inspects bore and breech mechanism after cleaning.			Lubricates howitzer and carriage.	Lubricates howitzer and carriage.	Removes, cleans, lubricates, and returns aiming posts.		
7	Verifies that there is an ample supply of emergency rations, oil, water, and gasoline.	Checks the contents of the section chest, and inspects for condition of chest and contents.			Inspects carriage for loose or missing nuts, bolts, rivets, and broken welds; looks for excess grease or oil under carriage.				
8		Replace breech portion of overall howitzer cover.			Cleans, lubricates, and returns fuze setter to section chest.	Replace muzzle portion of overall howitzer cover.	Replaces muzzle cover.		
9							Properly stores unused cleaning and preserving materials.		
10	Receives reports from members of the section as they complete inspection and maintenance operations.	Reports, "Gunner ready."	Reports, "Assistant gunner ready."	Reports, "Number 1 ready."	Reports, "Number 2 ready."	Reports, "Number 3 ready."	Reports, "Number 4 ready."	Reports, "Number 5 ready."	Reports, "Driver ready."
11	Reports to battery executive "Sir, number ( ) in order."								

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Table I. Duties in Prepare for Action

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5
1	Commands PREPARE FOR ACTION. Supervises work of cannoneers during all activities.	Commands UNCOUPLE. Disconnects the blackout light system from the prime mover.	Removes the blackout system from the piece and places it in the section chest. Moves to right trail handrail.	Moves to left trail handrail.	Moves to right trail handrail.	Move to the muzzle, set the brakes if directed, and assist by placing their weight on the tube.		Moves to left trail handrail.
2			Assists number 1 to lift the lunette.	Unlatches the pintle and lifts the lunette from the pintle.	Assists number 1 to lift the lunette.			Assists number 1 to lift the lunette.
3	Commands ACTION FRONT. *Note.* If the command is ACTION RIGHT (LEFT), the movement is the same as ACTION FRONT, except that the howitzer is turned 90° in the appropriate direction.		Assists number 1 to turn howitzer.	Turns howitzer 180° in a clockwise direction after number 3 sets left handbrake.	Assists number 1 to turn howitzer.	Sets left handbrake.		Assists number 1 to turn howitzer.
4	If the piece is to be moved by hand, commands: 1. PIECE FORWARD (BACKWARD). 2. MARCH. Commands HALT, and the piece is stopped.	Directs the piece with the lunette.	Grasps right trail handrail. Moves the piece in the appropriate direction.	Grasps left trail handrail. Moves the piece in the appropriate direction.	Grasps right trail handrail. Moves the piece in the appropriate direction.	Ride the muzzle to balance the howitzer. If the piece is being moved up or down steep slopes, alternately set and release the handbrakes permitting the howitzer to pivot moving in a zigzag manner.		Grasps left trail handrail. Moves the piece in the appropriate direction.
5	Directs unloading of equipment and ammunition. Directs the driver to move the vehicle to the motor park.	Unloads ammunition and equipment.	Unloads ammunition and equipment.	Unloads ammunition and equipment.	Unloads ammunition and equipment.	Unloads ammunition and equipment.	Unloads ammunition and equipment.	Unloads ammunition and equipment.
6				Unlocks trail locking latch.	Disengages the drawbar locking shaft and rotates the drawbar 180° to the upward position.	Unlock and lower the bottom flap of the shield. Unlocks the left axle lock from the traveling position and locks it in the firing position.	Unlocks the right axle lock from the traveling position and locks it in the firing position.	Removes the trail handspike from the traveling position and places it in its socket at the rear of the left trail.
7			Lifts and spreads right trail assisted by number 2.	Assists number 5 to lift and spread the left trail when number 3 calls "spread."	Using the drawbar for leverage, assisted by the assistant gunner, lifts and spreads the right trail when number 3 calls "spread."	When he sees that number 4 has the right axle lock unlocked, he calls "spread," informing the assistant gunner, numbers 1, 2, and 5 that the trails may be spread.		Using the hand spike for leverage, assisted by number 1, lifts and spreads the left trail when number 3 calls "spread."
8		When the left trail is fully spread, locks it in position by inserting the trail locking pin into the forward hole (firing position).	When the right trail is fully spread, locks it in position by inserting the trail locking pin into the forward hole (firing position).	When directed removes the rammer staff from its traveling position, assembles it to the rammer head (bore brush), and assists the assistant gunner in cleaning the breech mechanism, chamber, and bore.	Arranges ammunition and equipment assisted by numbers 3, 4, and 5.	Unfasten the front of the overall cover and fold the front flaps back to the gunner and the assistant gunner.		Places the section chest to the left of the gun.
		Gunner and assistant gunner together receive the front portion of the overall cover from numbers 3 and 4 and remove the cover to the rear. The assistant gunner folds cover and places it on the ground to right of the right wheel.					Removes muzzle cover and places it to the right of the right wheel.	Lays telephone wire from his piece to the switching kit.
		Removes the panoramic telescope from its case and seats it in the telescope mount.	Operates the elevating handwheel to assist number 3 in unlocking the cradle lock strut.			Unlocks the cradle lock strut, assisted by the assistant gunner operating the elevating handwheel, and locks it in the firing position.	Removes the aiming posts from the traveling position, assembles them and places them to the right of the piece.	Assists number 2 in arranging the ammunition and equipment.
9	Verifies that the recoil mechanism contains the proper amount of oil.	Uncovers the telescope mount leveling vials matches elevation indexes (fine and coarse) on telescope mount; sets index of rotating head at zero; sets deflection at zero; levels mount by centering both bubbles.	Uncovers the range quadrant leveling vials; sets site at 300 and centers bubbles; operates the breech mechanism and examines the breechblock, chamber, and bore, cleaning any parts requiring it (assisted by number 1 when so directed); leaves breech open. Removes the elbow telescope from its case and seats it in its mount when so directed.			Assists number 2 in arranging the ammunition and equipment.	Assists number 2 in arranging ammunition and equipment.	
10		Test and aline (boresight) fire control equipment.		Emplaces and holds the testing target if required.				
11	* Measures site to the mask, assisted by the assistant gunner: 1. Sights along lowest element of bore. 2. Directs the assistant gunner to elevate or depress the tube until the lowest element of the bore just clears the highest crest in the field of fire. 3. Directs the assistant gunner to center cross-level and longitudinal-level bubbles. 4. Reads the sight to mask from the range quadrant scales and reports to the executive "Sir, number ( ) site ( ) range ( )." (Gunner's quadrant may be used.) 5. Records and announces minimum quadrant for each charge to the gunner and assistant gunner.	* Lays howitzer for direction: 1. When the command is given identifying the aiming point, identifies aiming point through telescope, and announces "Number ( ) aiming point identified." 2. Centers the level bubbles on the telescope mount. 3. Executive commands NUMBER ( ) DEFLECTION ( ). 4. Sets announced deflection on the panoramic sight. 5. Commands MUZZLE RIGHT (LEFT) to aline the line of sight with the aiming point. A deviation of 10 mils or less may be alined with the traversing mechanism. 6. Checks that longitudinal- and cross-level bubbles are centered. 7. Reports to executive "Sir, number ( ) ready for recheck." 8. Repeats steps in 4 through 7 above until executive announces, "Number ( ) is laid." (Lay of tube will not be disturbed until an aiming point is established. Unit standing operating procedure will specify the deflection at which the aiming posts will be displaced.) Assists chief of section to measure site to mask.	Assists chief of section in measuring site to mask. Assures that 300 is set on the angle of sight scale, and centers the cross-level bubble. Shifts the right trail as directed by the gunner.	Shifts the left trail as directed by the gunner.	Assists the assistant gunner to shift the right trail.		Assists number 1 to shift the left trail.
12	* Indicates alternate aiming point to the gunner when one is designated by the executive. If an alternate aiming point is not designated, the chief of section should select a clearly defined point at a distance of at least 2,000 meters. This aiming point is to be used as directed by the executive or at such times when the aiming posts are rendered useless. Deflections read from the panoramic telescope are recorded and reported to the executive and are used to maintain parallelism, until the aiming posts are reemplaced.	* Directs alinement of aiming posts. 1. Sets aiming post deflection on the panoramic telescope. 2. Directs number 4 by hand signals to aline the far aiming post with the vertical reticle in the panoramic telescope. 3. Directs number 4 to aline the near aiming post with the far aiming post and the vertical reticle in the panoramic telescope. 4. If because of the nature of the terrain the aiming posts cannot be set out at base deflection, turns azimuth micrometer knob until the nonslipping azimuth scale is on an even hundred-mil graduation. 5. Alines the aiming posts at this new deflection. 6. Reports to the executive: "Number ( ) aiming posts at ( ), deflection ( ) in lake (or other reason)." 7. The executive will then command for example, NUMBER ( ), DEFLECTION 2800, REFER. 8. Loosens the locking screw and moves the slipping azimuth scale to deflection 2800. Tightens the locking screw and verifies the adjustment. Lays on alternate aiming point: 1. The piece has been laid. 2. The executive may command AIMING POINT, LEFT FRONT, LONE TREE, REFER. 3. Without moving the tube, refers the sight to the aiming point. 4. Reads the deflection and reports "Number ( ), deflection ( )." *Note.* The executive may record the referred deflection for future use, or he may proceed as follows: 5. Commands COMMAND DEFLECTION, 2800. 6. Loosens the locking screw and moves the slipping azimuth scale until 2800 is in coincidence with the index on the door. 7. Unlocks slipping azimuth micrometer scale locking nut, and moves the slipping azimuth micrometer scale to zero. 8. Tightens the locking nut and verifies that zero is in coincidence with the index. 9. Verifies that the line of sight is on the aiming point.					Sets out the far aiming post approximately 100 meters to the left front of the piece as directed by the gunner. Sets out the near aiming post midway between the piece and the far aiming post as directed by the gunner.	
13	Verifies that the howitzer is prepared for action. Reports to executive "Sir, number ( ) in order" or reports any defects that the section cannot remedy without delay.	*Note.* All cannoneers take posts after they have performed their specific duties.						

* These steps may be omitted during training when drill does not include laying of the piece.

Table II. Duties in Firing, Indirect Laying

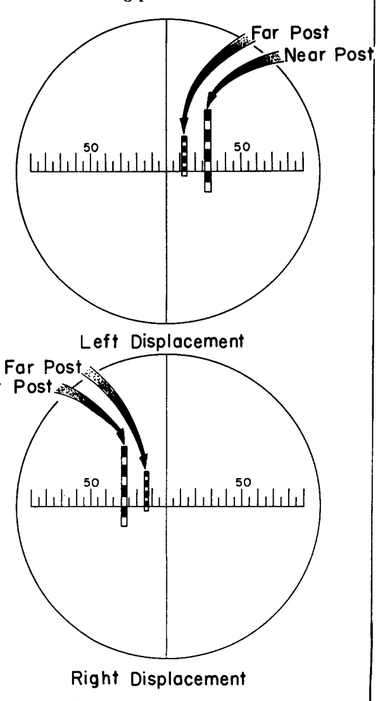
Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5
1	Commands the section during firing and insures an efficient and safe operation.							
2	Follows fire commands and repeats commands to the section as required to insure efficiency and safety.	Sets and lays for deflection. 1. The command is, DEFLECTION ( ). 2. Sets announced deflection on the panoramic telescope by releasing the throwout lever with the left thumb and turning the rotating head to the closest 100 mils. Releases the lever and sets off the mils remaining on the micrometer scale. 3. Traverse piece until vertical line of telescope is on the left edge of aiming point. *Note.* Final motion of traverse is from left to right. 4. Checks pitch- and cross-level bubbles, and verifies alinement with the aiming posts.	Sets and lays for quadrant: 1. Insures that the angle of sight scale is set at 300. 2. The command is QUADRANT ( ). 3. Sets the announced quadrant by turning the range quadrant knob to the closest 100 mils, and setting off the mils remaining with the micrometer knob. The last motion should be in the direction of increasing reading. Elevates tube until the longitudinal-level bubble is centered. 4. Centers cross-level bubble. Opens and closes the breech. 1. Grasps the breech operating lever handle with the left hand, depresses the handle, and draws it toward the rear to open the breech. 2. Grasps the breech operating handle with the left hand, and pushes it forward until the breech is closed and the latch is engaged.	Loads the howitzer: 1. Steps toward number 3 with the left foot and receives the prepared round from number 3: *a.* Grasps the base of cartridge case with the right hand. *b.* Grasps the projectile in front of the rotating band with the left hand. 2. Loads at the command QUADRANT: *a.* Inserts round in the breech. *Note.* Avoid striking the fuze against any part of the howitzer. *b.* Pushes the round home with the right fist. ***Warning:*** **A fist must be used to protect fingers from being crushed when the breechblock is closed.**	Fuzes projectiles: 1. The command is FUZE ( ). 2. Removes fuze or closing plug. 3. Inspects fuze socket for rust or dirt. 4. Removes or replaces supplementary charge as required. 5. Screws in designated fuze, using authorized fuze wrench. ***Caution:*** **Do not hammer on a fuze wrench or use an extension handle.** 6. Removes safety pull wire from time fuzes. With fuze setter M26, sets fuzes TSQ M54, TSQ M55, MT 67, TSQ M500, TSQ M501, TSQ M520. 1. Seats upper lug of fuze setter in the upper recess of the fuze. 2. Loosens wingnut on fuze setter, sets announced time on the appropriate time band. 3. Locks wingnut, places handle to horizontal, turns counterclockwise until a stop is felt and a click is heard. 4. Raises handle, removes setter, verifies setting. With fuze setter M28, sets fuze VT M513-series: 1. Seats stationary lug of setter into top recess of fuze. 2. Sets announced fuze setting on the fuze setter. 3. Turns setter clockwise until setter stops or a click is heard. 4. Removes setter and verifies setting. Sets selective super quick and delay fuzes: On fuze quick, verifies that letters S.Q. are alined with the slot on the setting sleeve. On fuze delay, turns setting sleeve with screwdriver until the slot is alined with the word DELAY. Combination time and super quick fuzes: For impact the command is FUZE M500 (or other fuze) QUICK. Verifies that the letter S on the setting ring is alined with the index on the fixed ring. ***Caution:*** **A time fuze should be returned to ordnance after being set twice.** *Note.* The wrench type fuze setter, M27, may be used to set time fuzes. Engage setter in fuze knotch and rotate in the direction of increasing readings until the time setting is opposite the index mark on the fuze. This type of setter should be used only when mechanical setters are not available.	Prepares propellant charge: 1. The command is CHARGE ( ). 2. Verifies the number of increments. 3. Removes increments that are higher numbered than the charge commanded. 4. Replaces remaining charges in the cartridge case in their numerical order. Fits projectile into its cartridge case assisted by number 5. *Note.* Care must be exercised to prevent damage to the lip of the cartridge case. Holds projectile upright for fuzing and fuze setting. 1. Selects proper projectile as commanded. 2. Holds the projectile firmly while Number 2 fuzes and sets the fuze. When directed reads and announces the time set on the fuze. Passes prepared round to Number 1 with his left hand under the cartridge case and his right hand under the projectile so that Number 1 can grasp the base of the cartridge case. *Note.* Insure that the projectile and the cartridge case do not separate.	Remove ammunition from containers and arrange them within easy reach of number 3. 1. Remove the tape from the cartridge end of the container and tilt it so that the cartridge case can be taken by Number 3. 2. Reverse container, remove the tape, and tilt it so that Number 2 can receive the projectile. Inspect and clean projectile: 1. Examine rotating band to see that it is free from all dirt and burrs. *Note.* Projectile with burred rotating band will be put aside until the burrs can be removed with a file. 2. Examine entire projectile for defects. 3. Stand projectile on end and clean it thoroughly. *Note.* Any sand, dirt, oil, or grease on the projectile will cause wear, scratches, or gouges in the bore.	Assists Number 3 in preparing charges.
3	Indicates that the howitzer is ready to fire after the assistant gunner calls "Set" and the gunner calls "Ready," by extending his right arm vertically and reporting "Number ( ), Ready." *Note.* The chief of section will designate one cannoneer to hold up the unused propellant.	Calls "Ready," after the piece is laid for direction and the assistant gunner calls "Set."	Calls "Set."		*Notes.* Care and proper handling of ammunition must be insured. It is imperative that— 1. There be no smoking in the vicinity of ammunition. 2. Only flashlights be used in vicinity of charges. 3. Rough handling of projectile, cartridge cases, and fuzes be prevented. 4. Projectiles and cartridge cases not strike together. 5. Ammunition not become dirty, wet, or overheated.			
4	Gives the command to fire by dropping his arm sharply to his side and commanding FIRE.		At the command and signal of the chief of section,, fires the howitzer by pulling the lanyard with the right hand.					
5	Observes and checks functioning of materiel during firing: Reports promptly to the executive any mistakes, unusual incidents, equipment malfunctions, and any reason the howitzer may not be fired.			Stacks expended cartridge cases in rear of the right trail where they will be out of the way of the section. Inspects the bore and chamber after each round is fired to see that it is free from residue left by the charge and calls "Bore clear." Calls out number and quadrant for each round in volley fire. On the last round adds "Last round."				
6 (These duties performed as required.)	Lays for quadrant with gunner's quadrant: 1. The command is USE GUNNER'S QUADRANT. 2. The announced quadrant is set on the gunner's quadrant. *Note.* Increments of 10 mils are set on the quadrant frame arc. 1 mil and 0.1 mil increments are set with the micrometer knob. The same side of the quadrant must be used for settings on the quadrant frame arc and micrometer. 3. After the howitzer is loaded and laid for direction— Stands squarely opposite quadrant seats. Places and holds gunner's quadrant firmly on the seats. Insures that the words *line-of-fire* are on the bottom of the quadrant and the line of fire arrow is pointed toward the muzzle and is on the same side of the quadrant as the scale used. 4. Directs the assistant gunner to elevate the tube until the bubble is centered. Cautions the assistant gunner when the bubble is approaching center so that the final centering may be expedited. *Note.* For subsequent settings, the chief of section will take the same position, hold the quadrant in the same manner, and view the quadrant bubble from the same angle to insure consistency in leveling. Measures the quadrant: 1. The command is MEASURE THE QUADRANT. 2. With the piece laid, directs the assistant gunner to center the cross-level bubble, insure that the angle of site scale is set at 300, and turn the elevation knob until the bubble in the longitudinal-level vial is centered. 3. Reads the quadrant set on the range quadrant scales. 4. Reports to executive officer "Number ( ) quadrant ( )." *Note.* The quadrant can also be measured by placing the gunner's quadrant on the breech ring quadrant seats and centering the bubble by moving the index arm and turning the micrometer knob. Conducts prearranged fires in conformity with prescribed data (e.g., barrages, harassing, and interdiction fires). Commands CEASE FIRING. 1. Command may be given by anyone. 2. All firing will stop immediately. 3. If the howitzer is loaded reports that fact to the executive, who will acknowledge with "Number ( ) loaded." 4. The executive will then investigate the cause, correct it, and resume firing by announcing the quadrant. 5. If CEASE FIRE is commanded by the fire direction center, fire is resumed by announcing the quadrant.	Corrects for aiming post displacement when the vertical reticle in the panoramic telescope is displaced from the line formed by the aiming posts. He lays the howitzer so that the far aiming post appears exactly midway between the near aiming post and the vertical reticle.  *Figure 17. Correction for aiming post displacement.* *Note.* If displacement is caused by traversing, lay as described above. If displacement is caused by shifting of the carriage due to firing shock— 1. Lay as above until there is a lull in firing. 2. Notify chief of section for permission to realine the aiming posts. 3. Lay howitzer as described above. 4. Direct Number 4 to move the far post into alinement with the vertical reticle and then aline the near aiming post. Refers the piece: 1. The executive commands AIMING POINT THIS INSTRUMENT (or other point) REFER. 2. Does not disturb the lay of the tube. 3. Checks centering of bubbles. 4. Refers sight until the vertical reticle is on the designated point. 5. Reads the deflection and reports to the executive "Sir, Number ( ), deflection ( )." *Notes.* 1. Each time the weapon is traversed, the gunner must center the longitudinal- and cross-level bubbles on the panoramic telescope mount, and the assistant gunner must insure that the longitudinal-level bubble and the cross-level bubble are centered each time the weapon is elevated or depressed. 2. Individual piece corrections will normally be added to the common deflection and quadrant, and the total deflection and quadrant are announced to each piece (e.g., deflection number 1 3030, quadrant, number 1,357). The gunner's aid should therefore remain at zero.					

Table III. Duties in Direct Laying

Sequence	Chief of section	Gunner	Assistant gunner	No. 4	Nos. 1, 2, 3 and 5
1	Conducts fire of howitzer: 1. Takes control of his section and fires the howitzer when the executive commands TARGET, TANK, RIGHT (LEFT) FRONT, FIRE AT WILL or simply FIRE AT WILL. 2. Alerts section to prepare for direct fire.	Prepares panoramic telescope for direct laying: 1. Centers cross-level bubble. 2. Verifies that the gunner's aid index is set at zero. 3. Zeros the nonslipping azimuth, the slipping azimuth, and the slipping micrometer scales.	Checks elbow telescope.		Perform same duties as in indirect laying.
2	Identifies or selects target: Identifies target designated by executive. 2. If target is a group of vehicles, selects the target that is the greatest threat to his position or the supported position based on this priority. *a.* Tanks at short range threatening to overrun the position. *b.* Hull down stationary tanks covering the advance of other tanks. *c.* Area containing personnel threatening to overrun the position. 3. Repeats target designation to the section "Lead Tank," "Moving tank." Takes post to the flank and slightly to the rear of the piece where his observation will not be obscured by muzzle blast and smoke. Estimates range to target: 1. A range card (fig. 11) with accurate measurements to key points provides the most accurate ranges. 2. Estimated ranges are used if accurate measurements are not available. Determines lead in mils: Lead is based on target speed, range, direction of travel, and ammunition used. Approximate initial leads are as follows: *Speed (MPH)* — *Lead (mils)*: *Target traveling perpendicular to line of fire*; *Target traveling 45° to line of fire* Slow: 5 — 5 — 5 10 — 10 — 5 Medium: 15 — 15 — 10 20 — 20 — 15 Fast: 25 — 20 — 15 30 — 30 — 20				
3	Gives initial commands: *Sequence* — *Element* — *Example* 1. Target designation — TARGET (TANG, etc.) 2. Projectile, charge and fuse* — SHELL HEP-T (no charge or fuse required) SHELL HE, CHARGE 7 FUZE QUICK or SHELL HE, CHARGE 7, FUZE DELAY. 3. Lead — LEAD, RIGHT (LEFT) 10. 4. Method of fire — FIRE is continuous unless otherwise commanded. 5. Range — RANGE 600.	Sets initial lead on the gunner's aid and zeros the micrometer scale. Traverses howitzer until the center vertical reticle is centered on the target and maintains this sight picture by continuous tracking of the target. Withdraws eye slightly and commands FIRE, after the assistant gunner calls "Set." *Note.* The gunner and assistant gunner track the target in deflection and elevation, as a team, while adjusting for the correct sight picture. They will continue tracking after the round is fired and make corrections as directed by the chief of section.	Elevates or depresses the piece until the target is centered on the appropriate range line in the reticle. *Note.* The reticle in the elbow telescope is patterned for use with shell HE, Charge 7, and shell HEAT. To use shell HEP-T with the elbow telescope, prepare a conversion table by comparing the elevations for shell HEP-T with the ranges for Charge 7, and use that range with the Charge 7 reticle for laying on the target. Maintains target on appropriate range line by continuous tracking. Calls "Set," and withdraws eye slightly from the elbow telescope.	Opens and closes the breech. Taps the assistant gunner on the shoulder when the piece is loaded to indicate the piece is ready to fire. Fires when the gunner commands "FIRE."	
4	Gives subsequent commands based on observed effect: 1. Change in lead — RIGHT (LEFT) 5 2. Change in range — ADD (DROP) 100	Actions taken for subsequent commands. While the gunner and assistant gunner continue to track the target, the chief of section gives commands based on observed effects. When the chief of section commands—RIGHT (LEFT) ( ). 1. Sets lead change on the gunner's aid, and zeros the micrometer scale. 2. Traverses the piece until the center vertical reticle is again centered on the mass of the target. 3. Checks that the cross-level bubble is centered. 4. Commands FIRE, after the assistant gunner has called "Set."	When the chief of section commands— ADD (DROP) ( ). 1. Elevates or depresses the piece until the appropriate range line is centered on the mass of the target. 2. Calls "Set." *Note.* During the laying sequence, checks the direction of the lead as set by the gunner.		
5	Commands END OF MISSION when target is destroyed or neutralized. New targets will be selected and taken under fire as outlined above.				

* Ammunition and fuze selection.
Ammunition and fuze combinations are as follows:
1. Shell HEP–T is designed for, and is highly effective against tanks and armored vehicles.
2. Shell HE, Charge 7, fuze quick is ideally suited for antipersonnel fire and is also effective against tanks and vehicles.
3. Shell, white phosphorous, may be used to set stalled tanks and other vehicles afire and produce casualties.
4. Fuze delay may be used for ricochet effect. The point of impact is adjusted 10 to 30 meters in front of the target. If less than 50 percent of the bursts richocet, change to fuze quick.
5. Fuze time is the least desirable and should be used at ranges of 1,000 meters or greater. Areas effectively covered by air and ricochet bursts are similar.

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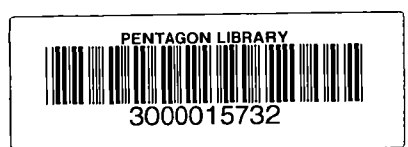
	Fire commands are the same as above.	Lays for both deflection and range: 1. Matches the elevation indexes. 2. Sets elevation indexes and azimuth scales to zero. 3. Centers the cross-level bubble. 4. Sets lead on the gunner's aid and zeros the micrometer scale. 5. Lays the intersection of the center vertical reticle and the appropriate range line on the target. *Note.* The reticle on the panoramic telescope is graduated for shell HE, Charge 5. When firing Charge 7, at ranges under 2,400 meters, use one-half of the true range for laying on the target. For shell HEP–T use one-third of the true range for ranges under 2,000 meters. 6. Commands FIRE.	Opens and closes the breech. Calls "Set" when the howitzer is loaded. Fires the piece at the gunner's command.		

Table IV. Duties in Preparation for Traveling

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	Driver
1	Commands March Order. Inspects the piece to insure that it is not loaded. Supervises the work of all members of the section throughout all sequences.	Assists number 3 in locking the cradle locking strut by placing the piece in the center of traverse. Withdraws the left trail locking pin from the forward hole (firing position) and inserts it in the rear hole (traveling position).	Inspects the chamber to see that the gun is unloaded; closes the breech after inspection by the chief of section. Closes cover on range quadrant vials. Assists number 3 in locking cradle locking strut by operating the elevating handwheel. Withdraws the right trail locking pin from the forward hole (firing position) and inserts it in the rear hole (traveling position). Picks up gun cover from the right of the gun and places it over the cradle. Moves to right trail.	Moves to his position at the left trail prepared to assist in closing it.	Moves to his position at the right trail prepared to assist in closing it.	Locks the cradle locking strut in traveling position assisted by the gunner operating the traversing handwheel and the assistant gunner operating the elevating handwheel. Releases the left handbrake.	Releases the right handbrake	If removed, inserts the trail handspike in its socket in the rear of the left trail. Moves to his position at the left trail prepared to assist in closing it.	Drives the prime mover to the howitzer position as directed by the chief of section.
2		Fit the overall cover over the breech end of the howitzer fitting the holes of the cover over the traveling lock shaft; leave the cover draped over the cradle.	Assisted by number 2 closes right trail when number 3 calls "close." Verifies that the traveling lock shafts fit into the traveling lock brackets.	Using the handspike for leverage, assisted by number 5, closes the left trail when number 3 calls "close."	Using the drawbar for leverage assisted by the assistant gunner closes the right trail when number 3 calls "close."	When he sees that gunner and the assistant gunner have finished fitting the holes of the gun cover over the traveling lock shaft, calls "close" to assistant gunner, numbers 1, 2 and 5 indicating that the trails may be closed.	Picks up the muzzle cover, and after the tube has been inspected by the chief of section and found cleared, fastens the cover on the muzzle.	Using the handrail for leverage assists number 1 in closing the left trail when number 3 calls "close."	
3		Sets the rotating head and deflection of the panoramic telescope at zero. Closes the covers on the telescope mount level vials. Removes telescope from its mount and places it in its case; locks the case.	Removes the elbow telescope, if mounted, and places it in its case.	Locks the trail locking latch after the trails are closed.	Disengages the drawbar locking shaft and rotates the drawbar 180° to the downward position, and reengages the drawbar locking shaft.	Locks left axle lock in traveling position by rotating the crank of the axle lock crank assembly 180° out toward the wheels and engages the lock in the outer hole.	Locks the right axle lock in traveling position by rotating the crank of the axle lock crank assembly 180° out toward the wheels and engages the lock in the outer holes.	Removes the handspike, fastens it in its carrying socket on the left trail. Picks up wire from executive's control station and other wire as directed.	
4	Inspects for proper march order specifically the trail lock, cradle traveling locks, cradle locking strut, and handbrakes.	Fit and fasten the breech end of the overall cover		Disassembles the rammer staff; removes the rammer (bore brush) and places it in the section chest; fastens the sections of the rammer staff in their brackets onto the left trail, if removed in prepare for action.	Prepares ammunition and equipment for loading in the prime mover, assisted by other members of the section.	Raise and latch the bottom shield flap; secure the overall cover over the forward part of piece.			
5		Assists the chief of section in supervising the march order.		Assists number 2 in preparing ammunition and equipment for loading in the prime mover.		Assists number 2 in preparing ammunition and equipment for loading in the prime mover.	Retrieves and disassembles the aiming posts, places them in their covers, and fastens them in their brackets on the right trail. Assists number 2.	Assists number 2 in preparing ammunition and equipment for loading in the prime mover.	
6	Commands COUPLE. Directs loading of tools, ammunition and equipment on the prime mover.	Loads equipment.	Loads equipment.	Loads equipment.	Loads equipment.	Loads equipment.	Lower the tail gate. Loads equipment.	Loads equipment.	
7	Directs maneuvering of prime mover until the pintle is almost over the lunette.		Grasps right trail handrail.	Grasps left trail handrail.	Grasps right trail handrail.	Releases left handbrake as directed.	Releases right handbrake as directed.	Grasps left trail handrail.	Positions prime mover as directed by the chief of section.
8			Raises the trails and places lunette in the pintle.	Assists the assistant gunner to raise the trails. Latches and locks the pintle.	Assists the assistant gunner to raise the trails.	Assist by placing weight on the tube as required.		Assists the assistant gunner to raise the trails.	
9		Connects blackout system cable to the prime mover.	Secures blackout system to the muzzle.						
10	Commands MOUNT (par. 13). Verifies that: 1. The handbrakes are released. 2. The blackout system is connected. 3. The pintle is latched and locked. 4. The equipment and personnel are aboard and secure. 5. The tailgate and safety strap are secure. Reports "Sir, number ( ) in order," or any defects the section cannot remedy without delay.	Takes post. Mounts in prime mover.	Takes post. Mounts in prime mover.	Takes post. Mounts in prime mover.	Takes post. Mounts in prime mover.	Takes post. Mounts in prime mover.	Takes post. Mounts in prime mover.	Takes post. Mounts in prime mover.	Takes post. Raises and fastens tailgate. Fastens safety strap. Mounts in cab of prime mover.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